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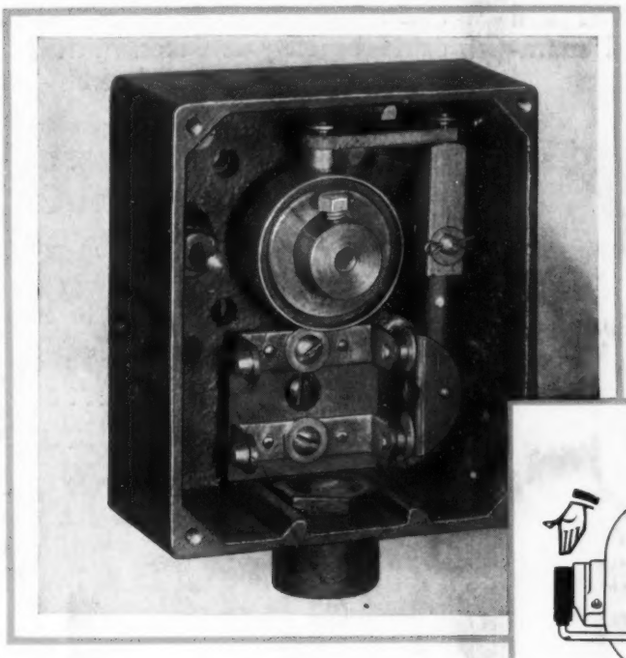

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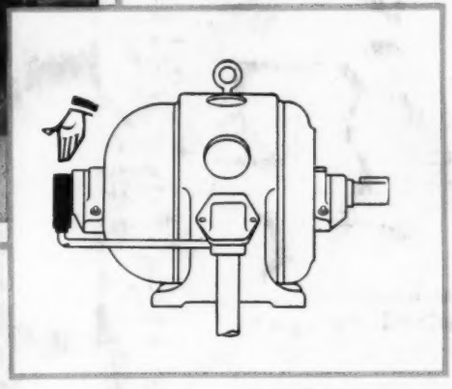

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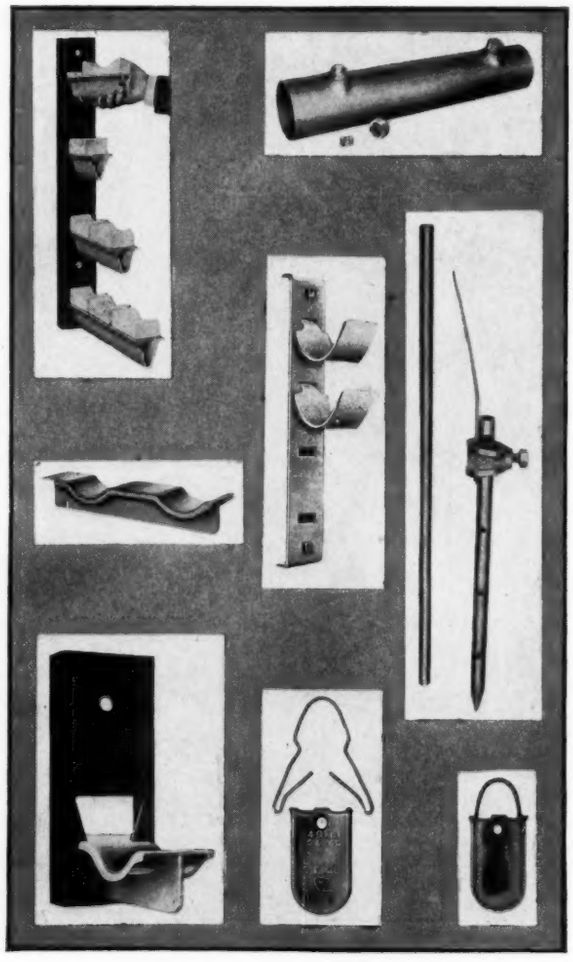

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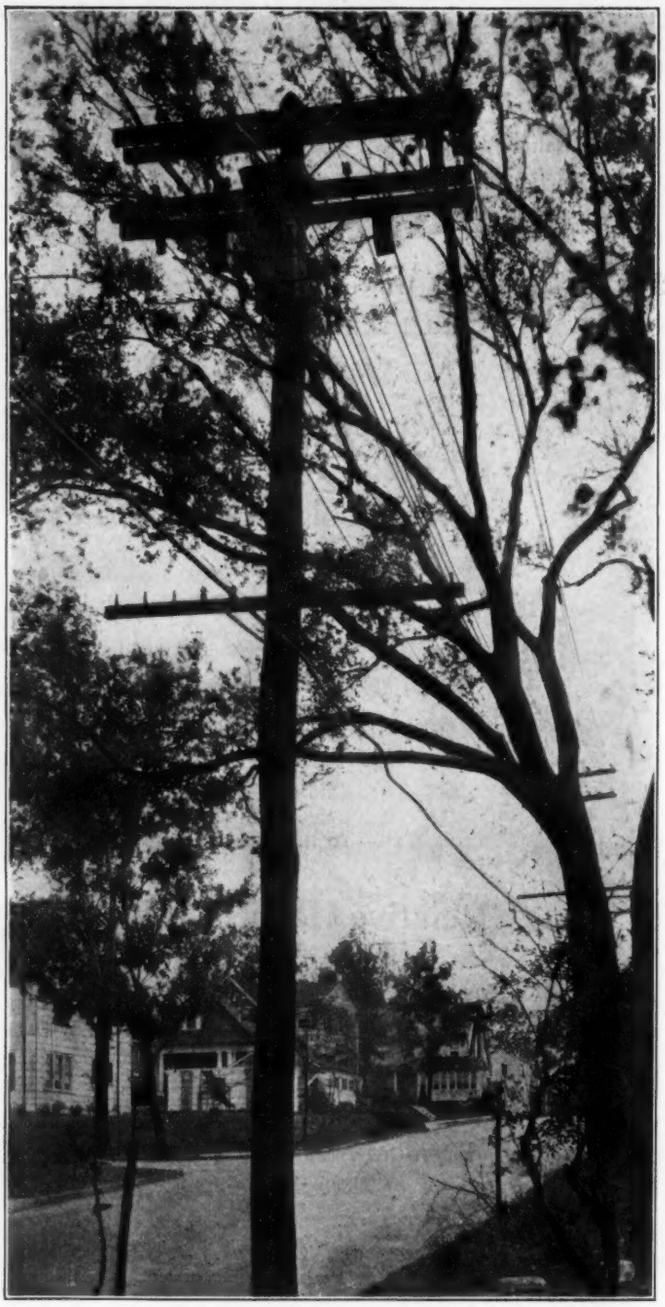

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Electrical World

A McGraw-Hill Publication—Established 1874

L. W. W. MORROW, *Editor*

Volume 94 *New York, Saturday, September 14, 1929* Number 11

Hope Deferred in Maine

ONCE again the effort to permit exportation of surplus hydro-electricity has been defeated in Maine. At the election on Monday the Smith-Carleton bill failed to pass by 8,000 votes, and a long, weary road stretches ahead of those who would bring greater prosperity to the Pine Tree State by the development of its hydro-electric power resources on a scale commensurate with modern economic opportunities through the interconnection of the state's water-power plants with the transmission lines of other commonwealths.

Public opinion is slowly growing to favor a constructive policy in place of electrical isolation, but while it grows many million kilowatt-hours are running to waste as the undeveloped rivers pour their unused energy into the sea, and the whole state is the poorer because of the blight of politics. Electrical development in Maine will continue. It is a pity that it should be retarded by an obsession against disposing of the state's surplus power in the only market open to it.

Maine's aversion to exportation is truly an economic form of phobia, but time will surely bring a reserve of common sense to bear upon the unfortunate situation.

❖

Why Not Reduce Elevator Car Weight?

STREET railway companies are alive to the avantages of light-weight cars, and various designs have been made using aluminum instead of steel for the car body. The steam railroads are building some of their passenger cars partly of aluminum. It requires less power to move the lighter car and there is less wear and tear on the roadbed.

Lighter-weight elevator cars will show even greater savings. Every pound taken out of the car reduces the counterweight in the same proportion, so that the mass accelerated and retarded is reduced twice as fast as the car weight. In some cases the next smaller size of ropes will be satisfactory, and this will further reduce the total weight. These lighter elevator cars are much safer as they reduce the force necessary to stop them. This means that the stresses set up in the car safety appliances and buffers are less.

Light cars take less power to operate as the energy stored in the moving parts during acceleration is less and most elevators start and stop frequently. Reduced weight of cars is of increasing importance as the speed is increased, because the energy stored in the moving weights at a speed of 900 feet is more than double that at a speed of 600 feet.

Every pound of car weight adds four pounds to the load on the elevator machine, using wrapped traction owing to the rope's passing over the sheave twice. The friction load is a direct function of the total load on the machine and auxiliary sheave. If larger ropes are necessary they add to the friction load. These factors reduce the efficiency.

A little thought and care and the use of new materials now available will enable the car designer to obtain the desired artistic results and keep the car weight much less than with existing designs.

❖

Pythagoras Vanquished

TWO serious mistakes were made when our system of geometry and of numbers was ordained. One was to make the circle incommensurate with its diameter and the other was the blunder of making three something other than one and a half or two or some other simple quantity. This circumstance has always been the Nemesis of students in electrical engineering. And it has to its discredit a large amount of interference with efforts to standardize transmitting and distribution voltages at the same time that attempts are being made to acquire what superior advantages are inherent in the four-wire "Y" over the three-wire delta systems.

But now we learn of an invention by our English friend William T. Taylor of a system of connections which he calls the "A" system. In brief, it involves a transition from "V" or open delta by an equal voltage across the third side, but by bridging (with two-thirds voltage) from the two-thirds points of the original "V" windings. The middle of this closing winding becomes a true neutral for the system, and herein lies all the merit of the proposal. It readily avoids the introduction of mongrel voltages arising out of the alliances built upon the inevitable three.

It promises to permit a symmetrical three-phase,

four-wire system, the use of polyphase transformers, better control of third harmonics, a minimum volume of maximum voltage to earth, four wires where now six or seven are used, and to promote economy, simplicity, safety and flexibility. An additional claim is that it consolidates three distinct systems—star, delta and "A"—into one, and all can be operated in parallel. Closer analysis will probably reveal that it incurs unbalanced voltages because of inequality of impedances in the various branches of the unsymmetrical circuit, just as Scott's "T" connection does; but it may nevertheless prove to have some degree of practicability in the transition now being effected from three-wire to four-wire distribution. There certainly is no reason for expecting that it will find a major use.

❖

Must Sales Departments Always Play the Fad?

IT HAS been the history of power-company commercial development that the fad of the season has always dominated selling. Time after time, as new popular merchandise has come along, it has been a case of off with the old love and on with the new. Away back yonder flatirons were dropped by the enthusiastic sales crews when the intriguing vacuum cleaner appeared. The cleaner was sidetracked for the clothes washer—and so on. Instead of putting added pressure and more man power on the broadened line, attention each time has been very largely transferred to the appealing innovation as if it were impossible for a central-station sales department to sell energetically more than one thing at a time.

Right now power-company sales of clothes washers and other small motor-driven appliances are being much reduced by the intense eagerness of these utility sales departments to sell refrigeration. They quite properly desire more domestic load. Refrigerators provide more load than washers, so why bother with this small-income stuff? Refrigeration is the present idea.

But, unfortunately, this kind of thinking is not only selfish but short-sighted. It disregards the interest of the household that the utility is obligated to serve. The power company wants load—yes. But the family at home wants all kinds of relief from drudgery and many kinds of comfort. Its members want and are entitled to, not just refrigeration, but a balanced electric service, one possible only with a complete electrical equipment. And if the power company is sincerely trying to promote a larger dependence upon electricity in family life, it must get the customers' viewpoint and see that the small-income appliance is not neglected. The value of an appliance to the public has nothing to do with load or vice versa—but in the long run the interest is obviously mutual.

Why can't the industry sell everything electrical at once? Why must it always play the fad of the hour?

Reduction of Noise in the Workshop

IMPROVEMENTS have been made in lighting, ventilation and the sanitary equipment of buildings. More recently means have been developed for deadening sound in offices. All such improvements have increased the efficiency of the persons occupied in these places by adding to their personal comfort and to the ease with which they can conduct their operations.

Much has also been done to improve the surroundings of workmen—for example, the noise of riveting has been abolished by welding—but there is still much to do before preventable noise in machinery is eliminated. Gearing is one of the most common sources of noise—due to inaccuracies in making the gearing, or to wear, or both. Still types of gearing are available which are quiet in operation and have high efficiency. Other noise is due to loose bearings and misalignment of parts.

Noise represents a loss that can be avoided. Quiet-running machinery contributes to better work and reduces the mental strain so that the shop is a better place to work. Everyone who is engaged in applying motors to machinery can contribute to the solution of this problem. Even though many machine noises may be beyond his direct control, the path of suggestion is always open.

❖

A Moral Tale of Rates

REASONS put forth for the expedients used in rate making frequently disclose influencing commercial and human factors that modify the logic of rate structures. One such factor that is revealed by a very successful rate form used by a representative transmission-type system in the North Central group of states is the theory of the minimum bill as distinct from the purely demand charge.

The company in question supplies no very large cities, and its industrial customers are not only comparatively few but also comparatively small. On account of the large area covered by the system, the fixed part of the cost to serve these customers is less a charge on system capacity—i.e., a demand charge—than it is a customer charge required by investment for service extension.

The rate used is a simple minimum bill form. The customers are gristmills, small foundries and machine shops, specialty factories and other local enterprises that compose the rather limited industrial activity of the average small town in the agricultural states. They like the rate because it has turned out to be an incentive for them to get business. The customer pays each month a minimum bill that includes, if he uses them, a certain number of kilowatt-hours. If he does not use them, he thinks he is paying for something he does not get, a condition of affairs that is peculiarly repellant to a man whose mental reactions are etched upon the background of prairie agricultural life. Ergo, he runs his factory.

He gets out and hustles for business himself or he tramples more heavily than usual on the tails of his salesmen. And quite often he finds that there is enough business to keep his plant going. Thus the minimum bill idea is of benefit both to the utility, for more often than not it sells kilowatt-hours above the minimum, and to the customer. The moral is that rate theorists wrangle while practical executives adopt expedients.

❖

Basic Values in Utility Securities

INVESTORS in electric light and power securities should not be stampeded by fluctuations in stock quotations into parting with their holdings without making sure after deliberate study that such sales are warranted by the economic circumstances in each particular case. It is not the province of the ELECTRICAL WORLD to offer its readers market advice, and the personnel of the electrical industry, now heavily interested in its financing, will make its own decisions in the investment field. None the less, it may well be emphasized that the basic values in utility securities in the United States are contingent upon earning power, operating efficiency, quality of management, opportunity for growth of service, kind of public relations existing, and other interrelated factors rather than upon momentary speculative opinion as reflected in tape quotations.

Light and power security prices are a complex of innumerable opinions, but these opinions rest finally upon the stability of the business and its future outlook. Those who buy such securities for profit and those who invest for income purposes are, of course, affected by price variations; but as long as this industry maintains its growth on a scale demanding economically justified capital additions of huge total yearly, basic values will assuredly continue on a high plane. Earning power is the cornerstone of this structure. When quotations reach levels above purchase prices which seasoned bankers are unable to forecast, one hears a lot about inflation, and without doubt many such prices either discount anticipated future earnings or reflect merger possibilities. But the purchasing power of the American public is a mighty force for stabilization of all sorts of securities backed by earning power and opportunity for great business development, and it is a question whether the potentialities of this buying capacity are as yet appreciated as generally as will be the case in another five years.

It should not be overlooked that power companies have made a dividend record of most commendable character over what is now a long period in the business history of the United States. The dividend percentage yields of many utility common stocks on market prices at this writing are far below those of not long ago, but the need for fresh capital brings stock purchase rights into the scale in such volume as to change completely the value index from this viewpoint. Where the stock dividend policy prevails, returns are, of course, proportional to market quotations. The problem there from the investor's angle is to determine a basic minimum yield upon which he may reasonably count amid the ups and downs of the market. Precisely the fundamental values indicated above must be studied in order to reach a conclusion. Procedure along this line is a far better guide to action or quiescence on the part of the investor than falling into the habit of tape watching during hours when other matters should absorb attention.

❖

Twenty-five-Cycle Energy Nears Limbo of Forgotten Things

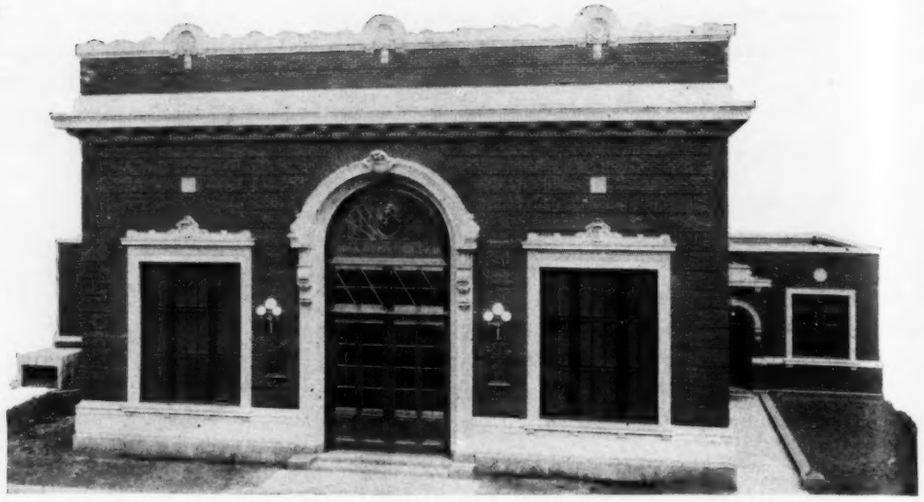
NEVER as satisfactory in general as the 60-cycle system, but still struggling heroically against the inevitable advance of change, the historically interesting 25-cycle system is making its last stand. The electrical engineers of the steel industry and of the power companies in Niagara Falls and New York City are the only significant "die-hards," and present indications point to several cases of early demise.

As in many other situations, economic considerations dominate, and it is not only a question of performance but of cost which brings uniformity nearer. Single-phase transformers in sizes from 10 kva. to 5,000 kva. are approximately 50 per cent more costly for 25-cycle than for 60-cycle designs. Motors from 5 hp. to 200 hp. show price differentials of 40 to 60 per cent in favor of 60 cycles when equipment of the usual speeds is compared. In 1928 25-cycle turbo-generators constituted only 3.1 per cent of the total capacity built for the year, amounting to but 46,500 kw. Generating equipment costs are about 5 per cent less for 60 than for 25 cycles.

The benefits and economies of interconnected operation provide another element in the situation, for in the case of power companies the interconnection capacities are definitely limited by the capacity of the frequency-changing apparatus installed, and the lack of flexibility and complexity of operational mechanics provide additional problems for the engineer. In the tying in of steel plants with power-company supply problems arise less acute but no less costly or perplexing. The reduction in spare capacity and possibilities for better division of total load with the same frequency offer real economies for the steel-plant engineer.

It would be surprising if further extensions either to the Niagara Falls system or to New York stations were to involve 25-cycle design, and the moment has almost come when a farewell may be said to the early system frequency. It served a good purpose for transmission and for conversion to direct current, but cannot stand against the economic advantages obtained by mass production and uniformity in utilization.

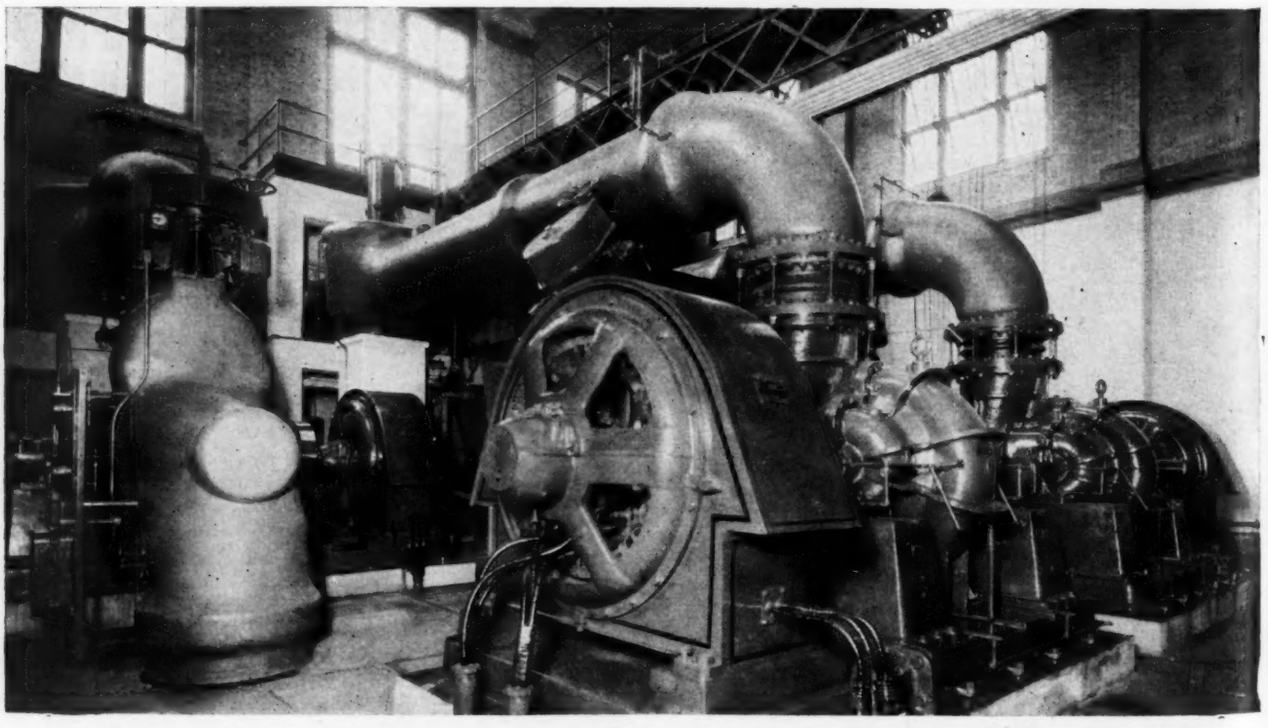
Chicago Pumps Water with Electricity



ELECTRICITY for pumping has been used in the Chicago water supply system for a number of years, but only lately has a pumping station designed solely for electric operation gone into service. Other electrical installations have been replacements in stations originally designed for steam. The new "Thomas Jefferson" station contains four 4,000,000-gal.-per-day Fairbanks-Morse centrifugal pumps operating against a supply pressure of 40 lb. per square inch.

The water supply is drawn from the feeder tunnel from Lake Michigan. The pumps are direct connected to General Electric 1,200-hp., 2,300-volt, 600-r.p.m. slip-ring motors. The motors have welded frames in which the protective hoods are incorporated. This construction has proved most effective in the reduction of motor noise.

As shown in the accompanying illustrations the size of the building is in striking comparison with the pumping capacity which it contains.



State Regulation Adequate

Centralized federal authority with its concomitant delays and heavy costs opposed to public interest and to interest of consumers of electricity throughout the country

By CARL D. JACKSON*
Former Chairman of Railroad Commission of Wisconsin

GRADUAL but constant encroachment upon and elimination of state authority by the federal government has become a matter of deep concern to all students of our form of government. Now the groundwork of this movement is the allegation that state authority and state commissions are inadequate to regulate public utilities efficiently.

ALLEGATIONS AGAINST STATE REGULATION

First—It is alleged that reasonable rates depend entirely on valuation and return and that the difficulty of ascertaining these factors renders state regulation ineffective.

Second—That holding or investment companies make a profit out of their ownership of common stock of public utilities or from the remuneration paid them by the utilities for service rendered; that such profit may be unreasonable, and that state authority is powerless in the premises.

Third—That though the states generally regulate utility service and rates and may and often do control utility security issues, they cannot effectively control the issuance of holding or investment company securities and that investors in holding or investment company securities may, therefore, be subject to losses; that, therefore, state regulation of the utilities is ineffective.

Fourth—It is often asserted that if the government could and would develop present undeveloped water power, there would be a flood of cheap energy available at a great saving to the consumer; that the states are without effective power in the premises and hence state regulation is ineffective.

Fifth—That part of the energy generated crosses state lines and becomes a matter of interstate commerce, and, therefore, the state commissions, being powerless as to interstate commerce, are ineffective.

Upon examination it will be found that the first of these allegations is made by believers in the theory that the rate base should be determined by the prudent investment and not by the value of the property; but whatever may have been said or argued in the past in respect to prudent investment as a controlling factor in regulation, the entire matter has been set at rest by repeated decisions of the United States Supreme Court.

While there has been much criticism of the holding company, it is clear that holding companies represent an economic movement highly beneficial in our industrial life.

Holding companies have existed in the utility field for some years and they have had a considerable growth in recent years. If holding companies have adversely affected the service and rates to consumers and the effectiveness of state regulation, such a fact should be apparent from a study of public utility service and rates.

As the state commissions fix the rates for all consumers of electrical energy and thus control the earnings of operating companies, it would seem as though state authority was as far-reaching as could be asked. It has, however, been seriously maintained that the charges made for services rendered by engineering, supervising or financial agencies controlled by holding companies may be unreasonable and cast an undue burden on the operating utility.

In respect to these contracts, like all contracts of a public utility, such as those for labor, coal or machinery, regulation has never sought to become the manager, but in fixing rates the commissions, as a matter of ordinary practice, scrutinize the operating expenses, including managerial contracts, and if they find over-reaching, fraud, abuse of discretion or manifestly unfair arrangements, these have not been allowed in rate fixing.

Contracts for supervising, engineering or financial service are on the same basis as other operating expense. Unless there is over-reaching or manifestly unfair arrangement, they are exclusively within the judgment of the directors and the commission is bound to accept them. Wherever it becomes necessary to act the power is complete and effective.

If it be alleged that the public is to be protected in the purchase of securities or stocks of holding companies interested in public utilities it is certain that the public should be protected also in the matter of securities of other holding companies. If a national "blue-sky" law is justified for holding companies of public utility stocks it is certainly justified for all other holding companies.

So far as the public interest in the sale and service of electricity is concerned, it is the interest of the consumer of electricity that is involved, and his protection, his whole interest, is bound up in state authority, and nothing more disadvantageous to him could eventuate than to have the federal government destroy that state authority on the pretext of protecting investors in the securities of holding companies.

**Abstract of address delivered at the forty-first annual convention of the National Association of Railroad and Utilities Commissioners, Glacier National Park, Mont., August 27-30, 1929.*

It may or may not be true that the states are powerless to regulate securities of holding companies, but it is not quite clear that the federal government could do so. States clearly have the authority to supervise the security issues of operating utilities, and some states have deemed it advisable to do so. However, about one-half the states have seen no reason to exercise the authority, and most states have "blue-sky" laws to protect investors.

Misunderstanding About Water Power

Another source of agitation against state authority arises out of a misunderstanding of the water-power situation. For some time it was believed by the general public, which, of course, has made no study of the subject, that there existed in the United States undeveloped water power offering a very cheap source of power for consumers, and that if the government would develop these water powers there would be an abundance of electrical energy available at a very small cost.

Now, of course, the actual fact is that the undeveloped water powers mostly exist in the West, in the Rocky Mountains, Sierras and Cascades. These are being developed as fast as economical use can be found for the electricity generated, and in many instances they have been the source of electrical energy at a comparatively low cost.

Such water powers, however, are not available for use after we have passed east a short distance from the Rocky Mountains. At present there is no reason to suppose that they will ever be available except in the territory contiguous to the mountains.

A large part of the present water-power development has taken place under state auspices. State power effectively to regulate rates and service has not suffered because some energy is developed from water power. The development of further water power where federal authority may be needed is already provided for in the federal power act. This federal act is not intended to act adversely on state regulation.

The existence of undeveloped water power is not an argument against the authority or effectiveness of state regulation, nor is it a valid argument for government ownership and operation, a belief in which is very often the basis for attacks on state authority and state commissions.

In a few of the states control over rates for electric service is in the municipalities, and in some of these states municipal authority has objected to the jurisdiction being placed in a state-wide commission. While I do not agree with this as a wise public policy, this much certainly can be said: That the municipalities that have not favored state commission regulation but have sought to hold that power for themselves certainly would not wish to have the power not only taken from themselves but taken away from the state and placed in a federal tribunal at Washington.

Interstate Commerce in Electricity

Of all electricity generated in 1296, 90.94 per cent represents an entirely intrastate movement and 9.06 represents the interstate movement. A considerable proportion of the interstate movement represents no change in ownership.

In every instance the consumer contracts with the local utility serving the community in which the service is rendered. He is not interested in where the electricity comes from, but is vitally interested in the service furnished him and the rates he pays for that service. He never contracts for the interstate movement of electricity. Every contract which he makes (and I mean by "contract" the terms under which he purchases, which are generally shown by the schedules and rules filed with the state commission) is for the furnishing of service locally. The delivery is made to him locally; he accepts it locally and every consumer in the United States taking electricity enters into an intrastate contract and never enters into an interstate contract. All regulation is bound up with that contract covering service and rates, and beyond that the consumer, which is the interested public, is not interested. If, therefore, state regulation is sufficient to control the service and rates under that intrastate contract, it accomplishes the complete purpose of any regulation.

Federal Regulation Problematical

There is always a possibility of federal legislation, and Congress may in the end find that some legislation is desirable. Assuming that at some future date it will be found that as a practical matter (and I do not think it will be so found) Congress should pass some legislation, I most respectfully suggest for your careful consideration, first, that any such legislation should be confined to the special matter that warrants remedial action.

Second—That such legislation should be confined wholly to such matter as adversely affects the power of a state commission efficiently to perform its functions, if any such there be.

Third—That only those states directly concerned should, under a delegation of federal authority, assume the solution of any such problem, with power to fix reasonable rates for interstate electricity, after it shall be found, upon investigation and hearing, that such rates are not reasonable.

Fourth—That any machinery thus authorized should be as simple as possible.

Fifth—There should be the right of court review, as in the case of all commission decisions and orders. This is essential as a matter of legality.

I do not believe that Congress, if it should ever see fit to legislate upon the matter, would desire to put in the hands of a federal authority powers over contracts for local consumption, authority over which can, under all circumstances, be far better handled and adjudicated with satisfaction to everybody by the state itself than could possibly be done by centralized authority in Washington.

At present we are confronted with a situation where no action at all has been taken by Congress. The moment any action is taken, the situation in respect to state authority is revolutionized. Unless the federal act itself is so drawn as not to interfere with state authority, all state statutes respecting the matter upon which Congress has acted are by that congressional action nullified.

I believe that state regulation is adequate and effective and protects the customers of electric service throughout this land. The states were pioneers in instituting effective regulation in all departments of public service. This fact was realized by Congress when it passed the federal power act, which specifically provides that where the state has the machinery covering electric rates, which might apply to the distribution of water-power energy generated under federal license, the state authority should not be interfered with.

Looking at the entire matter from a practical stand-

point and the interest of consumers of electricity throughout the country—that is, the public interest—may it not be fairly asked what benefit they would derive from any federal law concerning the fixing or determination of reasonable rates and adequate service, requiring appearance and procedure before a centralized authority at Washington, with its concomitant delays and heavy costs? Nay, is this not wholly opposed to the public interest—that is, the interest of the consumers of electricity throughout the country?

"Teletype" Expedites Service to Customers

PRACTICALLY instantaneous transmission of orders for customer service, with a resultant high speed in meter installations, merchandise deliveries, etc., has followed the introduction of an automatic electric telephone-typewriter system by the Delaware County Electric Company and the Delaware division of the Philadelphia Suburban-Counties Gas & Electric Company, subsidiaries of the Philadelphia Electric Company. The system covers the most active of the commercial offices of the companies, 16-18 East Fifth Street, Chester, and 9 South Lansdowne Avenue, Lansdowne, where connections are made for instant communication with the service headquarters at Morton and at Third and Broomall Streets, Chester.

The telephone-typewriter, or teletype, as it is called, is an instrument designed for electrical transmission of typewritten messages between two or more points equipped with sending and receiving machines. A message written on the sending machine appears simultaneously upon the receiving machine, with which it is synchronized.

The modern city newspaper secures a worldwide press service through a similar device, but certain changes and refinements were found necessary before its introduction into the electrical and gas industry was to become a successful possibility. The service order of the utility company, it might be explained, is ruled and spaced in such a way as to accommodate information upon a dozen different angles bearing on either a meter installation or a delivery of certain merchandise. The receiving machine must necessarily marshall the data into line, each into a space corresponding to that on the service order form of the sending operator.

There were features about the installation for the utility which were considered decidedly unique and called for exhaustive tests, running over a period of months, before a satisfactory result was obtained. As a consequence of these tests order forms were especially designed and adapted to the teletype so that the movements of the carriage and roller of both the sending and receiving machines are absolutely identical.

The new installation is being used for the transmission of all types of service orders for both gas and electric service, including meter installations and removals, shut-off and turn-on orders and miscellaneous service requests common to the industry.

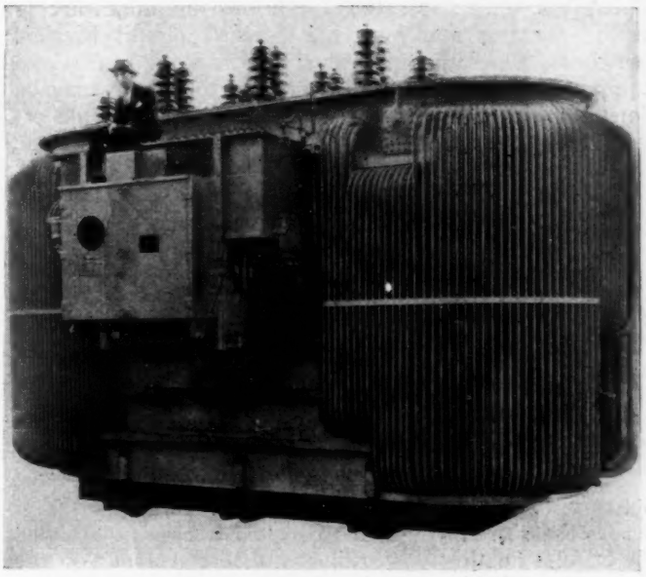
While certain details of its application are still in an experimental stage, the equipment has already proved its merits in speeding up customer service in general, leading to the prediction that additional installations may take place in other divisions of the companies.

13-Kv. Regulator of Record Size

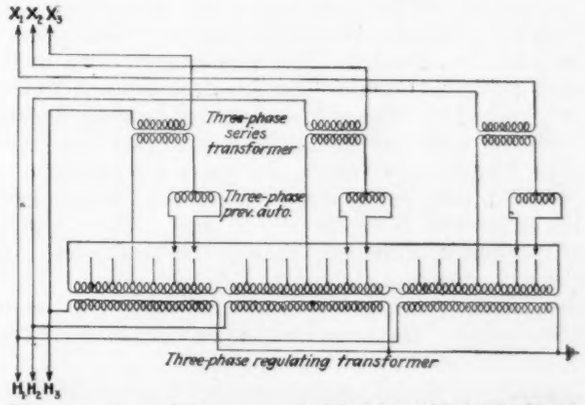
By S. S. Cook

Transformer Engineering Department, Westinghouse Electric & Manufacturing Company, Sharon, Pa.

ONE of the largest transformer regulating equipments for changing the voltage of a transmission line under load so far built was recently supplied by the Westinghouse Electric & Manufacturing Company for the Detroit Edison Company. It is installed at the Navarre station and is used as an interconnection between the systems of the utility company and the Ford



The Complete Assembly, 24 ft. Long, 11 ft. Wide and 17 ft. High



Connection Scheme of 30,000/50,000-Kva., 24/13-Kv. Regulator

Motor Company. By means of this equipment it is possible to regulate the voltage of one of the systems without breaking the circuit and so control the transfer of wattless current between the two. The approximate total weight, including oil, is 242,000 lb.

This outfit will regulate the voltage of a 30,000-kva., three-phase, 60-cycle, 13,200-volt line plus or minus 20 per cent in sixteen $2\frac{1}{2}$ per cent steps. It may be reconnected at the terminal board to regulate the voltage of a 50,000-kva., three-phase, 60-cycle, 24,000-volt line plus or minus 11 per cent in sixteen steps of approx-

imately 1⅓ per cent each. It is built for outdoor service, is of the oil-insulated, self-cooled type and is provided with "Inertaire" equipment. The assembly consists of a regulating transformer, series transformer and preventive auto-transformer, all mounted in one tank, with the tap-changing equipment mounted on the side of the tank.

To obtain the large number of voltage steps required, oil circuit breaker switches and tap selector switches operated under oil are used. The switching sequence is such that the oil circuit breaker switches close after, and open before, the tap selector switches, so that all arcing is restricted to the oil circuit breaker switches. Only two switch operations are required per tap change. This gives, under operating conditions, minimum arcing at the contacts and long life for the circuit breaker switches. Operation of the tap-changing-under-load equipment is normally by remote control, but it may be done manually, in case of emergency, by a handle attached to the mechanism. Interlocking prevents the use of one method when the other is being used.

A Floating Power Line

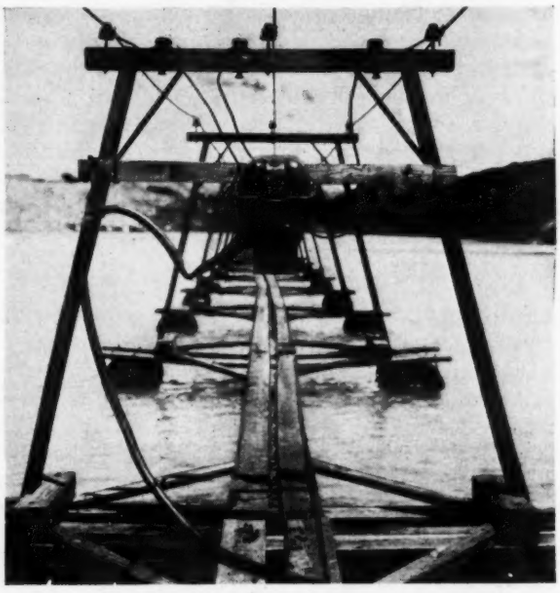
CARRYING energy at 2,300 volts for six 100-hp. pumping plants on barges, a floating power line nearly a mile in length has functioned effectively under severe conditions in the placing of the 11,000,000-cu.yd. earth dam of the Lexington Water Power Company on the Saluda River in South Carolina.

The floating pumping plants are located in a pool between two embankments, which are carried up first across the site of the dam to inclose a core of puddled clay. The floating power line is anchored about on the center line of this pool. Under normal conditions three pumping plants work along each side of the pool. They are held in place by cables lengthwise of the pool and are moved along these cables almost continually.

Each support of the power line rests upon two 55-gal. steel gasoline drums. Two 16-ft. planks crosswise form the base of the support. These planks are lashed to the drums with light U-bolts. The frame consists of 2x4-in. lumber, rigged as shown in the accompanying illustrations. The frames are spaced apart with two 16-ft. 2-in. planks. About every 100 ft. the floats are anchored on both sides by cables attached to concrete blocks large enough to hold the line generally in place. There is some slight movement from side to side, but no trouble has been experienced in high winds.

Power is delivered directly to the 100-hp. pump motors at 2,300 volts. This relatively high operating voltage for a job of this kind reduced the size of the wire required and thus cut down the weight to be carried by the floating line.

Take-offs for the pumps are located on every seventh to tenth frame. Three ordinary transformer cut-outs are attached to the top crossarm of the frame on the floats. Leads from these feed through a relay switch connected to a line to the floating pumping plant.



Supports and Take-off for Floating Power Line

From the take-off the power line is carried to the pumping plant on the float in a 2-in. continuous hose supported by gasoline drums. These hose sections are 250 ft. in length with a 1-in. stranded cable drawn through them. A chalk line twine was first blown through the hose by compressed air, and then a heavier line was pulled through to draw the cable.

At both ends of the hose the connection is made with tape and sealing compound. The whole connection thus formed is constantly exposed to severe moisture conditions. No trouble has, however, been experienced in operation. When the plant gets beyond the range of a take-off, the relay switch and the branch line in the hose are moved to the next take-off.

N. D. Urquhart is in charge of the construction of the Saluda Dam for the W. S. Barstow organization, with Messrs. Murray and Flood as engineers for the latter.

Floating Pumps Served from Floating Power Line

2,300-volt circuits are carried from floating power line to floating pumps in hose supported on empty gasoline drums.

Why Brooklyn Adopted
Low-Voltage A.C. Network

In order to provide better service to customers, increase safety for workmen and reduce capital investment network distribution with many unusual features is introduced. Design and operating data

By J. A. BROOKS
Assistant Outside Plant Engineer Brooklyn Edison Company

THE Brooklyn Edison Company adopted the low-voltage alternating-current network system of distribution for the following reasons: (1) Better service rendered customers because of extremely high continuity and better voltage regulation. (2) Safety to personnel; no need for working primary circuits alive to restore service quickly. (3) Economy; elimination of substations by distribution at transmission voltage.

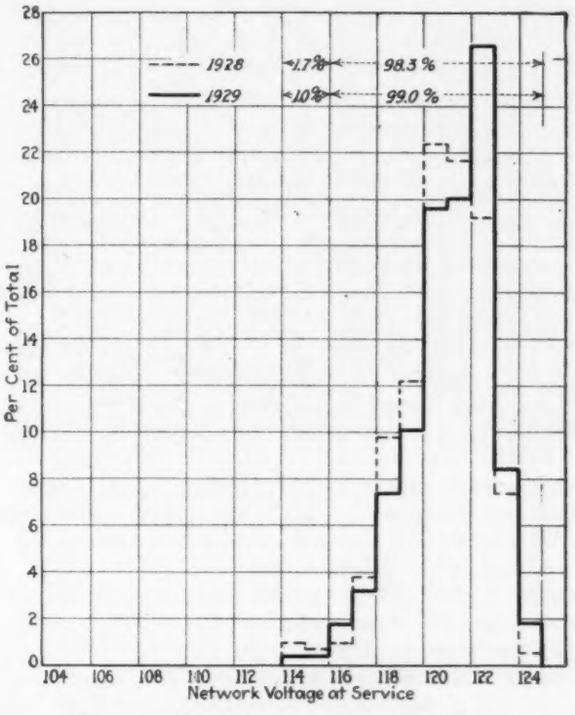
Before the adoption of the alternating-current network the Brooklyn Edison Company used the radial system of distribution. In this system the loss of any part of the circuit between the station and the customer interrupts service. The use of single-pole switching and automatic reclosing at the station, single-conductor mains, feeder sectionalizing switches and tie switches between sections of adjacent feeders and the practice of repairing primary faults alive reduced the duration of primary outages materially. However, there was still a very definite length of time required to arrive at the feeder in trouble, locate the fault and make necessary switching operations to restore service.

The paralleling of primary feeders through the secondary in the network system entirely eliminated interruptions to service by primary faults. Tests and the experience of other companies indicated that faults on low-voltage network mains properly designed and installed will burn clear at the point of failure, and in the majority of cases will not interrupt service.

In general, loads supplied from a low-voltage distribution system consist of a large number of small loads fairly equally spaced and a smaller number of heavier loads spaced unevenly and at greater intervals. These loads may not all reach their maxima at the same time, depending upon the nature of the area being served.

The secondary network system provides at least two secondary paths for all loads and four secondary paths for loads near the street intersections. Compared to a radial system, this distribution of the more concentrated loads over parallel secondary paths gives inherently better regulation for the same transformer spacing or satisfactory regulation with greater transformer spacing.

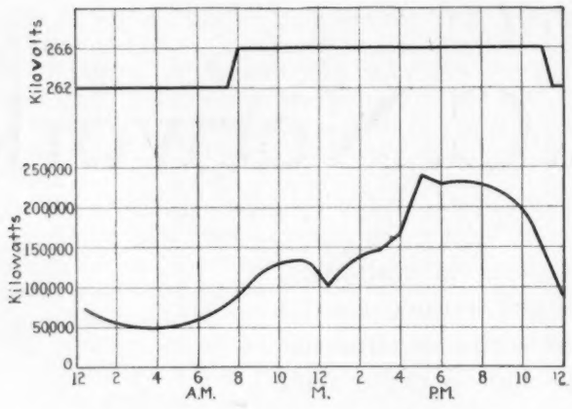
Since the loss of a primary feeder supplying a secondary network does not cause an interruption to service, ample time can be taken for locating and repairing primary troubles, and primary feeders can be made dead and properly grounded while repairs are being made, all of which results in less hazard to personnel.



Better Regulation Is a Feature of Network Service

The inherently better voltage regulation which may be expected with low-voltage alternating-current networks using same or greater transformer spacing as radial systems is illustrated by this survey of the Fourth Avenue network.

The elimination of the need for sectionalizing and tie switches on the primary mains and the elimination of the need for working primary circuits alive allowed the voltage of network feeders to be raised conveniently to 27,000 volts, which is the local transmission voltage of the Brooklyn Edison system. The use of higher primary voltage improves the primary regulation to a point where feeder regulators can be supplanted by a moderate daily variation in the generating station bus voltage. The substation is therefore no longer required and its



Primary Voltage Does Not Fluctuate with Load

This chart of conditions on the 60-cycle system of Hudson Avenue station indicates performance for 27,000-volt primary transmission.

elimination from the network scheme makes this system more economical than the radial system used heretofore.

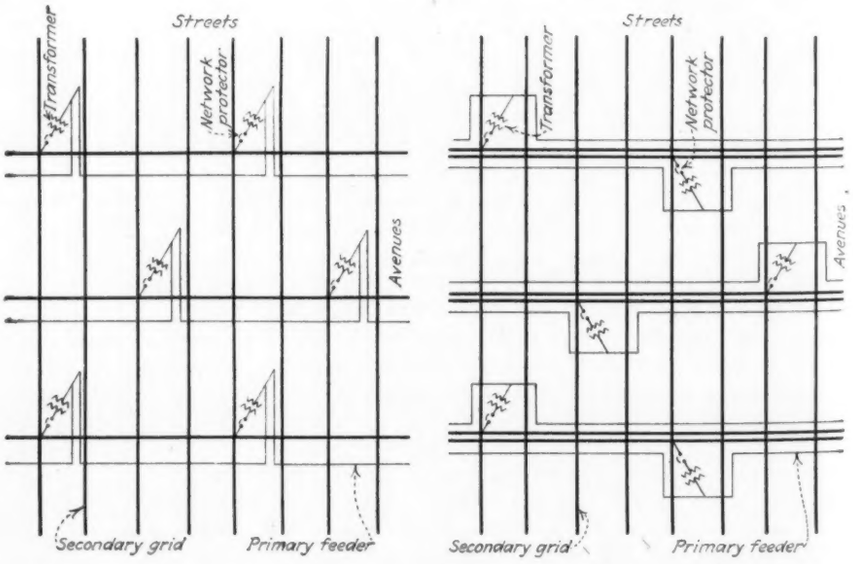
On the whole, Brooklyn is made up of streets running at right angles to avenues. The streets are approximately 260 ft. apart and the avenues are approximately 760 ft. apart. A three-phase, four-wire, 120/208-volt star secondary network system is used which consists of three 500,000-circ.mil single-conductor mains and one No. 4/0 bare neutral running down all streets and avenues and solidly connected together at the intersections. All three-phase conductors and the bare neutral are pulled in a common 4-in. fiber duct inclosed in a concrete envelope.

A service box 30 in. wide, 48 in. long and 36 in. deep is located along the mains approximately every 160 ft. A 3-in. wood pump log is run in the earth above the ducts carrying the mains for approximately 75 ft. from the service box in both directions. This pump log is broken at each service location and a cast-iron split "Y" placed over the break. Pigtails are spliced into the mains in each service box and a crab joint is spliced to the end of each pigtail. When a service is installed a small hole is made inside the curb at the nearest "Y" and a 2-in. iron pipe is driven from the customer's basement and connected to the "Y"; the service wires are pulled between the basement and the service box through the service pipe and pump log, connection being made at the crab joint; 500-kva., three-phase transformers having 26,400-volt delta-connected primaries and 125/216-volt star-connected secondaries are installed along the avenues at street intersections.

For average load densities in Brooklyn the transformers are spaced every four blocks, with those on adjacent avenues offset by two blocks to give a staggered arrangement. With four-block spacing load densities up to 12,000 kva. per square mile can be served with allowable voltage regulation. The installation of a second set of 500,000-circ.mil mains and a second primary feeder on the avenues, with alternate transformers connected to each primary feed, will allow the density to be increased to 17,000 kva., at which point the maximum allowable voltage drop occurs when the transformers are fully loaded. The installation of additional transformers to give two-block spacing, with alternate transformers connected to each primary feed, will allow the density to be increased to 32,000 kva. per square mile and a transformer capacity sufficient to give one-block spacing will allow a density of 50,000 kva. These figures are based on hypothetical uniformly distributed small loads taken from the mains at intervals of approximately 160 ft. These conditions never occur in actual practice, especially at the high load densities where there are usually a number of large loads concentrated at certain points in the area. In general, these large loads are supplied by multiple banks of transformers connected to form a small network, which is tied in with the street mains, this giving an irregular transformer spacing.

Where four-block transformer spacing is used a 15-hp. elevator motor will cause starting dips of from 0.7 to 1.5 volts at the point where the service is taken from the mains, or a dip of from 1 to 2 volts at the customer's service switch. These dips are slightly less for the smaller transformer spacings.

The capacity of a network system is limited by the regulation and the loading of the transformers and feeders with one primary feed out of service, rather than by the loading under normal conditions. When the primary feeders are run parallel to one another the loss of one feeder will cause the adjacent feeders to take up approximately 50 per cent of its load. With this arrangement the normal loads on network feeders could not exceed two-thirds of the feeder capacity. However, if the feeders are laid out so that one feeder is adjacent to a second feeder for only a short distance the load normally carried by a feeder out of service will be taken up by a large number of feeders and normal loads can much nearer approach the feeder capacity. The use of 27,000-volt feed makes it possible to connect a large number of network transformers to each feeder and with properly selected routes obtain considerable diversity



Network May Have Either One Set of Secondary Mains and One Primary Feeder or Doubled Facilities on the Avenues

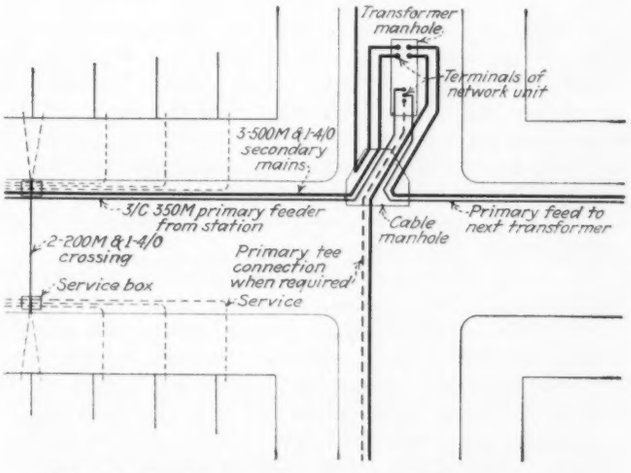
between lighting and power load, affording further economy in the primary design.

The loss in the Brooklyn transformers was limited to 5 kw. in order that it might be dissipated in small manholes without forced ventilation. This gave a transformer of more liberal design, which the manufacturers could guarantee for 50 per cent overload for two hours. It is planned to load the transformers normally from 80 to 100 per cent full load with an average of approximately 90 per cent, in order to take advantage of the overload capacity.

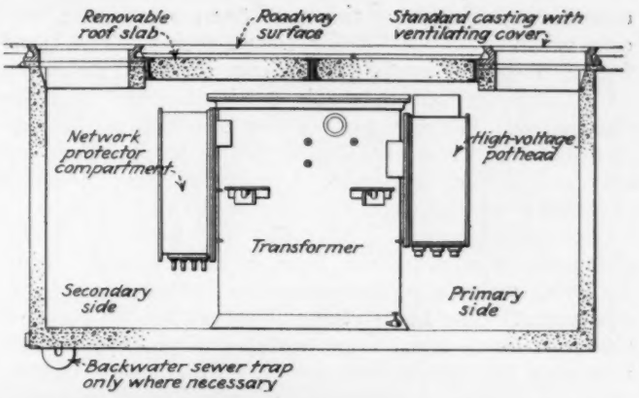
The transformer manholes are 4½ ft. wide, 16 ft. 10 in. long and 8 ft. deep. A 35-in. square opening is provided at each end with two removable roof slabs between the openings. When the two slabs are removed a space approximately 10 ft. long and the full width of the manhole is available for installing the transformer. The top of each slab comes to within 2 in. of the top of the concrete paving base, allowing smooth restoration of the paving surface. Access to the transformer is obtained through the opening at either end, as there is not sufficient room for a man to walk between the transformer and the manhole wall. The square openings are provided with grating covers to allow a free circulation of air for manhole ventilation.

Transformer manholes are installed in about the center of the street immediately back of the line of intersection. A cable manhole is located in the intersection at the point where the mains on the two streets cross. Four ducts are laid between the cable manhole and the transformer manhole and the mains from all four directions installed in these ducts directly to the transformer.

The network protector is located in a subway type compartment attached to the low-voltage end of the transformer. The upper terminals of the network protector connect directly to the transformer terminals of the network compartment from the transformer tank through bushings. The bottom of the compartment serves as a junction box, in which there are three buses about 1 ft. apart, running parallel to the long axis of the transformer. Each bus is provided with four thimbles for connecting four cables and is connected to one phase terminal of the switch through a fuse which also serves as a disconnecting link. Twelve wiping glands are provided in the bottom of the network protector compartment and are arranged in three rows of four each,



Typical Arrangement of Primary and Secondary Cables for Transformer at Street Intersections



Transformer (500 Kva.) Is Installed in Street Manhole

corresponding to the arrangement of the cable connections. The twelve cables from the cable manhole enter the bottom of the transformer manhole directly under the network protector compartment, one phase of each of the four sets of mains connecting to each terminal bus.

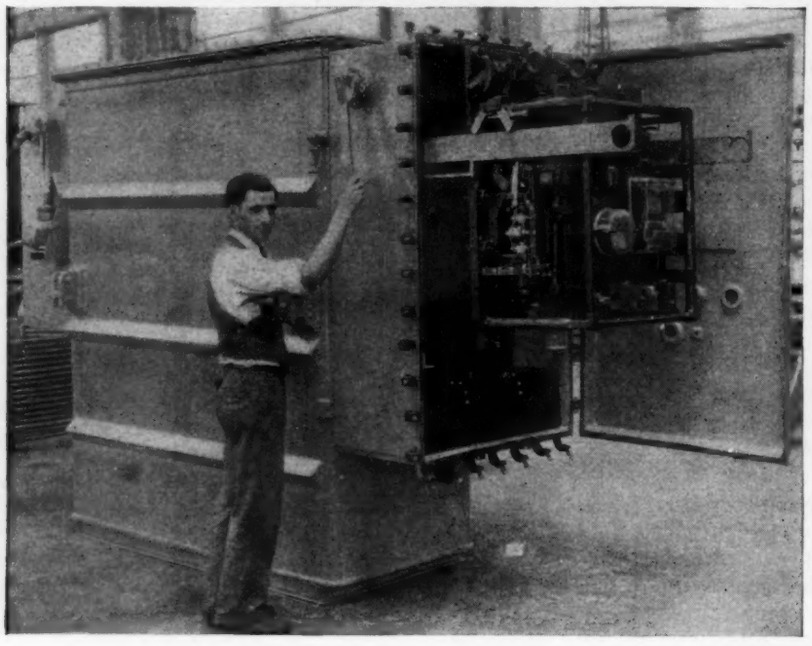
The terminal buses are mounted on a separate panel, so that when the fuses are removed and the connections to the transformer terminals unbolted the network protector can be withdrawn from the compartment. A roll-out device is provided which allows the protector to be rolled out to a point where a lifting hook can be readily attached and the protector lifted from the manhole through one of the 35-in. square openings. Red and green bullseyes are located in the door of the protector compartment for indicating the closed and open position of the protector. Two pipe plugs are also provided in the door so that the fuse and operation counter can be inspected without unsealing the compartment.

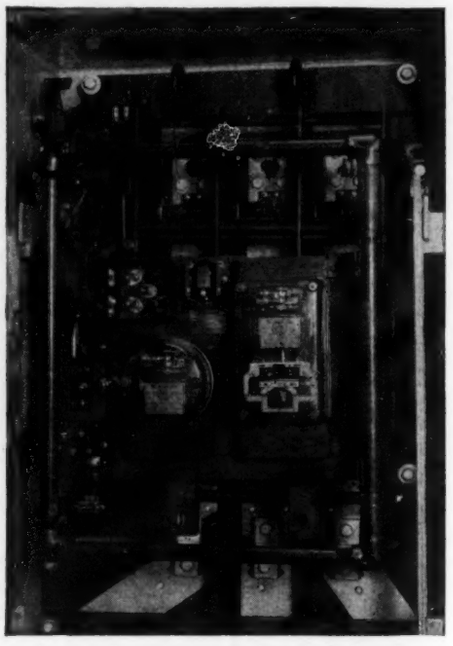
The high-voltage pothead is located on the opposite end of the transformer tank and is arranged for the entrance of three three-conductor cables through the bottom. Ordinarily only two cable entrances are used, one for the cable from the generating station and the

other for the cable to the next transformer, the third entrance being provided for future teeing. The transformer terminals in the pothead are arranged in the arc of a circle so that the cable conductors can be interchanged for phasing out without unsweating the lugs. A ground switch is provided in the primary pothead and arranged for closing with a portable jack, which is actuated from the street by compressed CO_2.

The selection of 27,000 volts for network feeders eliminated the need for taps in the network transformers, materially increasing the reliability of the equipment. The high-voltage bushings are arranged so they can be replaced from within the pothead without removing the transformer cover. Filter press connections are provided in the main transformer tank and also in the high-tension pothead for filtering the oil, portable oil-filtering equipment having been developed for this purpose. Before and after installation in the manhole the main transformer tank and the high-voltage pothead are tested for tightness with nitrogen pressure, nitrogen being used because it is not readily absorbed by oil and can be purchased commercially with very small moisture content. The network protector compartment is tested for tightness by the use of nitrogen pressure each time it is sealed.

The charging current taken by the feeder cables at 27,000 volts is sufficient to cause a serious voltage rise on the secondary grid if allowed to back-feed through the high reactance of the mains. This charging current would also prevent sensitive tripping of the network protector backfeeding due to the relay tripping characteristic not being a straight line and the value of charging current extending beyond the knee of the characteristic. In order to correct these two conditions, shunt reactors were developed and installed on network feeders to supply the charging current. These reactors have a capacity of 600 kva. and are inclosed in oil-filled tanks identical with the tanks used for the transformers except that a neutral switch is located on one end instead of the network protector compartment. The reactor is star-connected and wound on a five-legged core. The reason for using a star connection was to get maximum reactive kilovolt-ampere capacity under the condition of one feeder conductor grounded, the generating station breaker open and the feeder back-fed from the delta primary of one or more network transformers. When this condition obtains one leg of the reactor is short circuited and the two other legs overexcited. If a three-legged core were used the flux set up by the two energized legs would cause heavy short circuits in the short-circuited winding. The use of a five-legged core eliminates this condition and makes it possible for the manufacturers to guarantee a reactor to withstand the overexcitation of the two legs for a period of one hour after constant temperature at normal load without injury. A neutral switch is used so that the neutral can be disconnected from ground when the feeder is given the kenotron test between conductors and ground.





Network Protectors May Be Drawn Out on Extensible Rails for Removal from Manhole

Three-conductor shielded, paper-insulated cable is used for the primary feeders in order to make high-potential tests between conductors unnecessary and to give greater current-carrying capacity. A kenotron test between all three conductors and ground is applied to the feeder cable after installation and subsequently after rearrangement or repair. It is unnecessary to disconnect the transformers from the feeder during this test due to their primaries being delta connected and due to the manufacturers having guaranteed the transformers to withstand the tests without injury.

The relay equipment on the network protector consists of the standard three-phase network relay, supplemented by the standard single-phase phasing relay. In order to obtain sensitive tripping so that network feeders could be killed by merely opening the generating station switch, it was necessary to shift the tripping characteristics to a position at practically right angles to the network voltage. This was accomplished by adding resistance to the potential coil circuits.

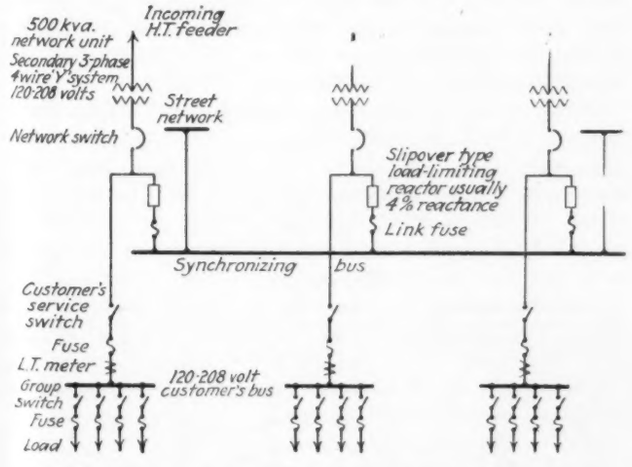
The network relays are set to close on differential voltages ranging from $1\frac{1}{2}$ to 2 volts. This setting was

made high due to there being considerable reactance between transformers and a flicker of 2 volts not being readily noticeable on the incandescent lamp. With this setting there is seldom more than one cycle of operation of any network protector per day. The phasing relays are adjusted so that their characteristic leads the network voltage by an angle ranging from 0 to 4 deg. This setting is high in order positively to stop any tendency for the network protector to pump and because of there being sufficient reactance between transformers to give these angles between transformer and network voltages before the network voltage becomes low. Where the load is of very low power factor it may be necessary to set the phasing relays to slightly lag the network voltage.

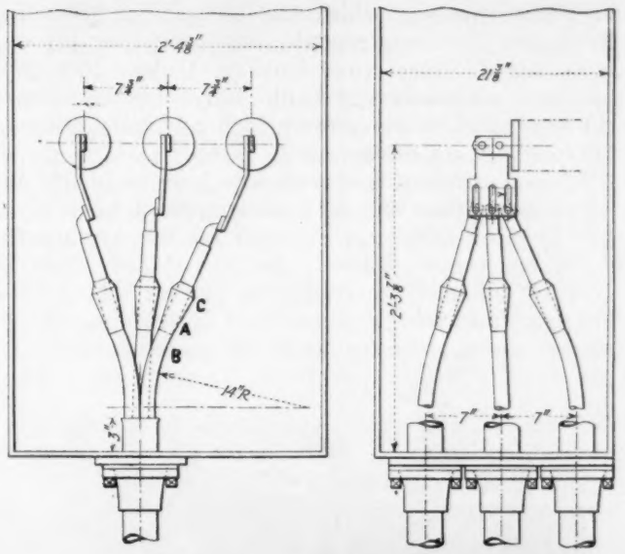
During 1927 a network was installed in South Brooklyn covering 0.64 square mile and supplied by eighteen transformers fed by three diversified 27,000-volt feeders from the Hudson Avenue generating station. In 1928 extensions to this network were installed covering 0.35 square mile with an addition of eight transformers. Five of these transformers were connected to the 27,000-volt feeders serving the original area and three were supplied by 4,000-volt distribution feeders from a nearby substation. A second network was also installed in 1928 in the northern section of Brooklyn covering 1 square mile and having 34 transformers supplied from four diversified 27,000-volt feeders.

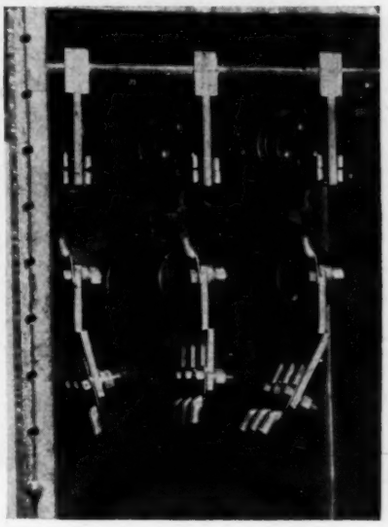
During 1929 extensions to these networks will be installed covering 3.7 square miles and adding 130 transformers supplied from the 27,000-volt feeders serving the existing areas. Two new networks will also be installed, one in the eastern and one in the northwestern section of Brooklyn, covering 1.5 square miles and having 52 transformers supplied from three additional diversified 27,000-volt feeders from the Hudson Avenue generating station. The total area networked will then be 7.2 square miles supplied from a total of 242/500-kva. transformers.

To date there have been four faults on network mains. Two of these were on radial mains fed from the network grid and cleared without appreciable disturbance. The two other faults were on the grid, one occurring at a duct edge and developing into a three-phase copper short circuit, which extinguished itself after the consumption of about 18 in. of cable; the fourth fault occurred in a section of iron pipe and burned back to the end of the iron before clearing. In this case it was necessary to replace two sections of cable. This experience, together with the results of tests made by various companies, indicates that the use of iron pipe for alternating-current network mains in general causes greater disturbance in the event of a secondary fault. For this reason the practice of installing network mains in iron pipe has been discontinued in Brooklyn. There have been three primary faults, all of which were cleared satisfactorily both at the generating station and network protectors.



Network Service Scheme for Typical Large Customer





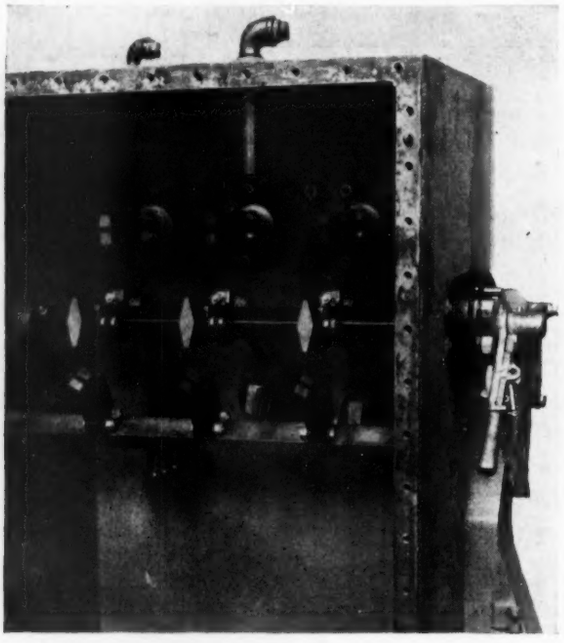
Pothead Transformer Terminals Are Arranged in Circular Arc to Permit Phasing-Out Without Unsweating the Lugs

The perforated metallic tape that surrounds the conductor is to be left intact to point *A*. Lead foil is to be applied on each conductor from *B* to *C* and secured with twine at *C*.

Network equipment similar to that described above for 27,000 volts has been developed for use on 4,000-volt distribution feeders from substations. The network protectors in the 4,000-volt equipment are interchangeable with those in the 27,000-volt equipment. Both primary and secondary windings are connected in star and wound on three separate single-phase cores. The use of separate iron cores was made necessary by single-phase switching at the substations. In Brooklyn it is the practice to clear single-phase faults on 4,000-volt radial distribution feeders by single-phase switching and continue operation on the two remaining phases. The use of a three-phase core in the 4,000-volt network transformers would make this practice impossible due to the inter-relation between the fluxes in a three-legged core. This equipment also has a three-way switch in

the primary pothead which may be used for grounding the feeder, for energizing the transformer or for disconnecting the transformer from the feeder. The third position is made necessary by the star-connected primary winding, which would prevent high-potential testing of the feeder if not disconnected.

Where customers have sufficient load to justify the use of more than one network equipment installed at their premises cable type iron core reactors are inserted in the connections between the transformer banks in order to minimize the circulating current set up by a difference in voltage between the feeders. These reactors are not effective under short-circuit conditions



High-Voltage Potheads of 4-Kv. Network Unit Have Three-Position Switch

Grounding the feeder, energizing the transformer and disconnecting the transformer from the feeder are functions served.

due to the saturation of the iron. It is therefore very difficult to obtain selectivity between the fuses associated with the banks should a short circuit occur on one feeder and the corresponding network protector fail to open. In addition short-circuit currents may flow into faults in the street mains which would blow the fuses, since these currents are much greater than those back-fed into primary faults. In order to prevent shutting down the customer in case of disturbance in the street the customer's bus is split into two parts, with half the lighting and power loads on each bus section. Each bus section is connected to a network transformer without fuses and to the street network through fuses. With this connection the failure of a network protector to clear a primary short circuit would cause a shut-down of part of the customer's load, but this is thought to be more desirable than a shut-down of all of his load due to poor fuse selectivity.

The selectivity of fuses on the network grid is also a difficult problem. Even though there is considerable reactance between the transformers it is not possible to prevent blowing one set of fuses when a secondary fault occurs near a transformer bank. However, fuses could be selected with definite maximum current-carrying capacities and definite minimum currents for blowing, which would prevent the loss of one transformer bank on a secondary short circuit overloading the adjacent banks, and so on until a whole series of transformers would be cleared from the mains.

Each week all network feeder breakers are opened at the generating station and the clearing of the back-feed noted. If the back-feed does not clear the faulty switch is immediately located and repaired. Periodic checks on the position of network protectors during load hours show whether or not the breakers are closing properly. This test and inspection indicate the condition of the network protector for operation. At present it is planned to open the network protector compartments once a year to inspect the switch parts, but this period will probably be lengthened as more experience is acquired.

Selection of Motors and Control for Skip-Hoists

By C. P. Hamilton
Industrial Engineering Department
General Electric Company

TWO types of alternating-current induction motors, the squirrel-cage and the wound-rotor, may be considered for skip-hoist drive. Because of the fact that, in starting a load, the squirrel-cage motor must absorb the accelerating losses within itself, the horsepower rating will be higher, ordinarily, than would be necessary if the skip were operated by a wound-rotor motor, since in this case the accelerating losses are dissipated in an external resistor.

To illustrate, assume a wound-rotor motor having a normal slip of 3 per cent at full load and a secondary resistor connected to it that will increase this slip to 12 per cent to obtain the speed-torque characteristic (shown in the figure) similar to a high-resistance rotor, squirrel-cage motor. Then one quarter of the loss (heating) is absorbed in the rotor and three-quarters of the loss in the external resistor. The squirrel-cage motor, on the other hand, must dissipate all of this heat within its rotor.

Obviously, for a skip operating on very intermittent duty, such as refuse handling, the rating of either type of motor may be selected as the nearest standard size above the horsepower required for hoisting. As the duty cycle becomes more rapid and continuous there is a very decided divergence between the rating of the two types of motors for a given duty.

From a large number of calculations on skips operating on fairly continuous duty cycles, as on a semi-automatic skip and fully automatic skip, the high-resistance rotor, squirrel-cage motor ranges in rating

Brake Sizes

This table indicates the proper size of brake to apply directly to the motor shaft. With speed reductions the brake torque must be increased proportionately to the reduction for the shaft to which it is applied.

Motor Hp.	Rating R.P.M.	Min. Brake Torque	Motor Hp.	Rating R.P.M.	Min. Brake Torque
7½	1,200	37	20	900	130
7½	900	50	30	1,200	150
10	1,200	50	30	900	200
10	900	65	40	1,200	200
15	1,200	75	40	900	275
15	900	100	50	1,200	280
20	1,200	100	50	900	310

from 1.25 to 1.5 times the horsepower required for hoisting. This refers to the 30-minute rated single-speed motor and the 60-minute rated 2:1-speed motor. In the case of the 30-minute rated wound-rotor motor ratings range from 1.15 to 1.30 times the hoisting horsepower required. This also applies to the direct-current motor. For a continuously rated wound-rotor motor the ratings average from 1 to 1.20 times the hoisting horsepower. Therefore, in selecting a motor for a particular duty, in practically 90 per cent of the cases a rating selected in accordance with these factors, and using a knowledge of the duty cycle, will be entirely adequate; that is, the nearest standard size motor above that calculated.

When skips handle abrasive materials, such as coke, the dust from which would be injurious to the motor insulation, inclosed motors are often used. Since an inclosed motor entirely dissipates the heat by radiation, such a motor must be particularly designed for each installation. Therefore, unless an open type motor can be used and a large inclosure provided around it to keep the dust out of the motor, complete mechanical data covering the hoist should be given the manufacturer for recommendations on a suitable inclosed type of motor.

In order to bring the skip to a stop and hold it when power is cut off the motor a brake should be used that, when applied to the motor shaft, will have a retarding torque at least equal to the full-load torque of the motor. If the brake is applied to some intermediate shaft its retarding torque should be increased in proportion to the gear ratio between the motor shaft and the shaft to which it is applied, as shown in the accompanying table.

Flexibility of Control Essential

To give successful skip-hoist operation the control selected should be designed to meet the essential characteristics of thorough reliability in every respect. In other words, for a skip requiring a given motor, the control must be such that the motor will be operated most economically to meet the capacity of the hoist and yet must at the same time be simple, reliable and require a minimum of maintenance.

The control should be designed for semi- and full-automatic operation of the hoist. Provision can be made to select either form of operation for a given hoist by means of a simple switch or snap switch type push-button station. Panels for non-automatic operation of unbalanced or counterweighted hoists are not essential, as the slight additional cost of a time relay for automatic return seems entirely justified for all skip-hoist installations because no time will be wasted by the operator in waiting for the skip to be returned to the loading chute.

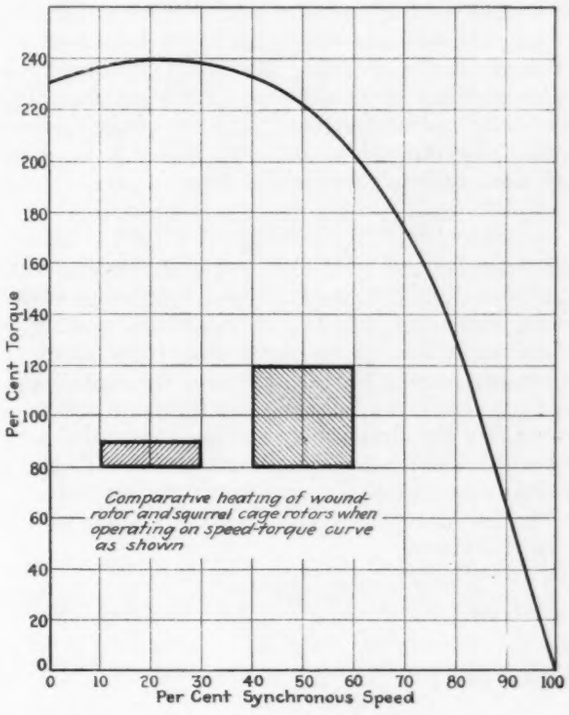
The control panels may be either open or inclosed. In the latter case the inclosing cover should be dust-tight; that is, it should prevent the accumulation of dust on the devices, but need not necessarily exclude dust entirely from the panel. The inclosing cases should be designed for mounting over the front of the panel only, leaving the back of the panel open for easy access to the connections.

For each control equipment a separately mounted line switch of the fused safety-first inclosed type should be used. In addition to minimizing the possibility of a workman coming in contact with live parts, such a switch also gives short-circuit protection to the equipment. In selecting the switches care should be taken to be sure that the proper size fuse is used. The following may be used as a guide:

For high-resistance rotor squirrel-cage motors the switch should accommodate a fuse capacity 2½ times the normal full-load current of the motor. For direct-current and alternating-current wound-rotor motors the switch should accommodate a fuse capacity 1½ times the full-load current of the motor.

Limit Switches Most Important

Limit switches are used to stop the skip automatically at the loading chute and at the dumping point, to give selective operation of the automatic return relay, and



Speed-Torque Curve Points to Importance of Losses in Accelerating

when necessary to slow the skip down just before it starts to turn into the dumping horns and before it reaches the loading gate. They are also used to protect against overtravel of the skip, and for this purpose separate limit switches of the hatchway type are used.

For single-speed skips an inclosed, cam-operated, geared limit switch is used for cutting off at the normal stopping points and two hatchway type limit switches are used for overtravel protection. If traction drive is used for operating the skip, track type limit switches should be used instead of the geared type because of the possibility of rope slippage giving inacurate operation of the latter type. For this type of single-speed skip two hatchway limit switches should be used instead of the geared type.

For skips operating at speeds ordinarily in excess of 125 r.p.m. the inclosed geared type limit switch should provide circuits for automatically slowing the slip down before it reaches the dumping horns and the loading gate. Should track type limit switches be desired instead of the geared type limit switch two hatchway switches should be used for stopping and two additional hatchway limit switches for slowdown. The latter switch

may have a fork lever, so that as the skip runs by it the lever will remain set in the position to which it had been tripped. The limit switch for stopping may have a roller lever with spring return. For overtravel protection the hatchway type switch similar to the normal stop switch should be used. Cams for operating the hatchway limit switches should be provided by the skip builder and attached to the skip carriage in such a way that they will positively engage the operating lever of the switches.

In order to obtain maximum flexibility from a geared limit switch the gear ratio should be so selected that approximately the maximum turns of the operating shaft will be obtained between the extreme limits of travel of the skip.

For slack cable protection a hand reset switch should be used. This should be a snap action switch on which movement of the operating arm of approximately $\frac{1}{4}$ in. will cause the switch to open. Such switches are designed to be operated by the movement of the mechanism provided by the skip-hoist builder which is actuated when slack cable occurs on the drum.

Emergency Stop Switches

For circuits not over 220 volts, alternating-current, or 230 volts, direct-current, a type of push-button station may be used which has two disk contacts, one for "up" and the other for "down" operation of the skip, and a snap switch section for disconnecting the control circuit. For higher voltages the snap switch is not suitable for interrupting the circuit and, therefore, a station may be used which has three disk contacts, the third being used for stopping and the snap switch section being used for keeping the control circuit opened when necessary on such a system.

For emergency stopping of the skip a single-disk type push-button station may be used, or an inclosed single-pole switch. If a push-button station is used with an automatic return control, it would not prevent the time relay from starting up the skip if in the dumped position, unless the button were held down to keep the control circuit open continuously. Such a push-button station would, however, bring a running skip to a stop and it could be started by depressing the proper button in the main control station. It is best to use a switch for emergency stopping which will keep the control circuit open and prevent starting until this switch is closed, which makes it imperative that the cause for the stop be corrected before the skip can be started from any point. A snap-switch type push-button station may also be used in this circuit which will be equally as effective as the switch.

Estimating Line Costs

FREQUENTLY it is necessary for district managers or other local representatives on wide-flung electric utility systems to make estimates of cost of line extensions. It may be that such estimates are used to determine local action only, as to the business advisability, for instance, of carrying service to more or less isolated points, or are used for the making of division budgets. Recognizing the value of putting line estimating information in the hands of those who may at one time or another have use for it, one Middle Western utility serving an area including much rural territory and many small towns has had prepared and has distributed material lists which include costs for the commoner types of line construction used on its system.

Cost of 1 Mile of 2,300-Volt Line

30-ft. poles spaced 175 ft. for two and three conductors of No. 6 and No. 4 copper

Material	Size (Ft.)	Quantity	Unit Price (Each)	Cost
Poles	25	1	$6.50	$6.50
Poles	30	30	9.85	295.50
Poles	35	2	12.90	25.80
Poles	40	2	16.95	33.90
Poles	45	1	18.85	18.85
Crossarms	4 pin	38	60.00 C	22.80
Crossarm braces	28 in.	76	10.80 C	8.21
Locust pins	1 in.	76	2.95 C	2.24
Cge. bolts	⅝x4½ in.	76	19.52 M	1.48
Machine bolts	⅝x12 in.	29	8.40 C	2.44
Machine bolts	½x14 in.	6	9.23 C	0.55
Machine bolts	½x16 in.	2	10.15 C	0.20
Machine bolts	½x18 in.	2	11.06 C	0.22
D. A. bolts	½x16 in.	4	13.84 C	0.55
D. A. bolts	½x18 in.	4	14.56 C	0.58
Sq. washers	2½ in.	100	15.64 M	1.56
Sq. washers	4x4x¼ in.	5	3.58 C	0.18
Lag screws	½x3½ in.	50	24.99 M	1.25
Guy wire	⅜ in.	500	17.15 M	8.58
Guy clamps	.....	12	19.79 C	2.38
Guy hooks	.....	10	7.79 C	0.78
Strain plates	.....	10	6.66 C	0.67
Guy thimbles	¼ in.	5	4.50 C	0.23
Insulators	No. 44	78	8.21 C	6.40
Strain insulators	No. 504	10	13.29 C	1.33
Wire soft drawn (tie wire)	No. 6	38 lb.	20.00 C	7.60
Traffic guards	.....	1	1.55 ea.	1.55
Total—material common to all				$452.33
Stores department—10 per cent				45.23
Labor				382.00
Transportation and supplies				95.00
Total—expense common to all				$974.56
Add to $974.56—For three No. 6 wires				
Anchor rods	⅝ in.x6 ft. 0 in.	5	54.95 C	2.76
Anchors (Everstick)	8 in.	5	2.00 C	10.00
Anchors MHD bare solid	No. 6	1,275 lb.	20.00 C	255.00
Copper sleeves	No. 6	3	9.00 C	0.27
Total—additional material				$268.03
Stores department—10 per cent				26.80
Total—all material and labor				$1,269.39
General office supervision				$126.94
Total—for three No. 6 wires				$1,396.33
Add to $974.56—For two No. 6 wires				
Anchor rods	⅝ in.x6 ft. 0 in.	2	$54.95 C	1.10
Anchors (Scrulix)	6 in.	3	1.53 ea.	4.59
Wire MHD bare solid	No. 6	836	20.00 C	167.20
Copper sleeves	No. 6	2	9.00 C	0.18
Total—additional material				$173.07
Stores department—10 per cent				17.31
Total—all material and labor				$1,164.94
General office supervision				116.50
Total—for two No. 6 wires				$1,281.44
Add to $974.56—For three No. 4 wires				
Anchor rods	⅝ in.x6 ft. 0 in.	5	54.95 C	2.76
Anchors (Everstick)	8 in.	5	2.00 C	10.00
Wire MHD bare solid	No. 4	2,020	20.00 C	404.00
Copper sleeves	No. 4	3	10.00 C	0.30
Total—additional material				$417.06
Stores department—10 per cent				41.71
Total—all material and labor				$1,433.33
General office supervision				143.33
Total—for three No. 4 wires				$1,576.66
Add to $974.56—For two No. 4 wires				
Anchor rods	⅝ in.x6 ft. 0 in.	2	54.95 C	1.10
Anchors (Scrulix)	6 in.	3	1.53 ea.	4.59
Wire MHD bare solid	No. 4	1,352 lb.	20.00 C	270.40
Copper sleeves	No. 4	2	10.00 C	0.30
Total—additional material				$276.39
Stores department—10 per cent				27.64
Total—all material and labor				$1,278.59
General office supervision				127.86
Total—for two No. 4 wires				$1,406.45

The lists are made up for mile units of line to cover the average condition, but since each item is specified and priced separately it is easy for the estimator to set up figures for any distance less or greater than a mile or for special conditions to be taken into account.

The tabulation presented here is a combination of four separate lists covering 2,300-volt, single-circuit construction on 30-ft poles spaced 175 ft. for two and three conductors of No. 6 and No. 4 copper. To the total figures for each condition there must be added costs of right-of-way, clearing right-of-way, higher poles, if any are necessary, and for such other special features as may be required. In later issues will appear material and price lists for 33-kv. construction and for underbuilt telephone circuits for load dispatching.

Compact Bridge Control

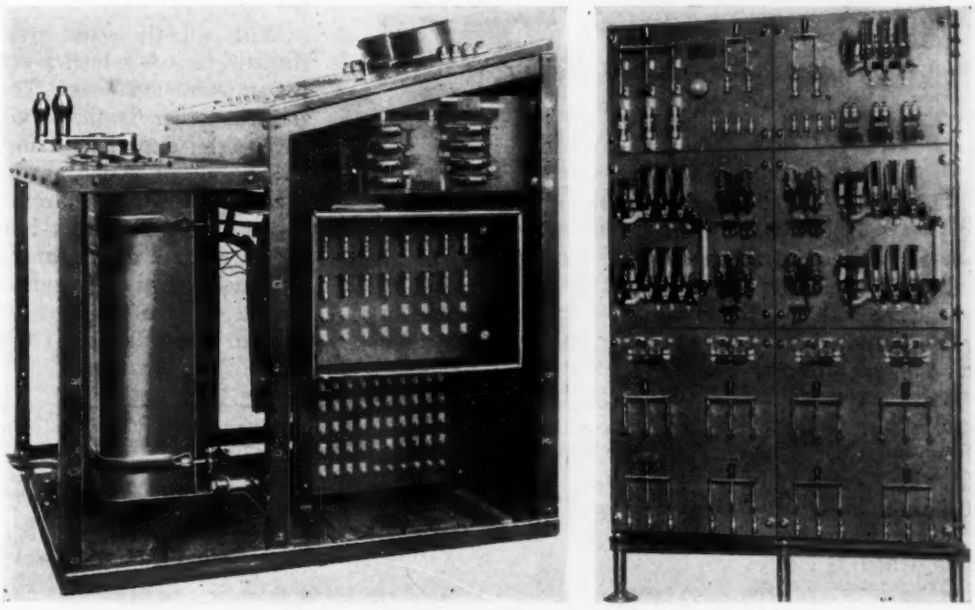
By P. B. Harwood

Electrical Engineer Cutler-Hammer, Inc., Milwaukee, Wis.

IT IS an essential consideration in the operation of bridges over navigable waters that the control be concentrated and be simple. These requirements are admirably filled in the new Dorchester Bay Bridge at Boston, Mass., which is equipped with Cutler-Hammer control of the latest type. This bridge is of the bascule type and each leaf is operated by two 15-hp., three-phase, 60-cycle slip-ring motors. The two traffic gates at each end of the bridge are driven by small squirrel-cage motors. The control for the bridge and gates is incorporated in one panel, which mounts the various contactors and relay required, and an operating benchboard. The primary circuits of the two leaf motors are handled by a pair of magnetic reversing switches mounted on the control panel. The pilot control circuits for the reversing contactors and for the relays which handle the brakes on the bridge are in a duplex drum controller, which also handles the secondary of the motors directly without any contactors. A total of eight speed points and a drift position in each direction is provided. There are two sets of brakes on the motors, one used for normal operation and the other for emergency only. The first set of brakes is controlled from the main drum, but the emergency brakes are under the control of another switch on the benchboard, so that in normal operation they do not function, but are always released. A limit switch is provided on each leaf to disconnect the motors and set the brakes when the leaf has reached the full-open or the full-closed position.

The squirrel-cage motors for the gates are all connected behind a magnetic contactor. This contactor is closed when the bridge is closed. If the bridge is open a limit switch operates to trip out the brake contactor and prevents the gates from being opened while the bridge is up. Interlocks are also provided, so that it is impossible to raise the bridge when the gates are open. There is a disconnect switch for the gate motors and a small reversing drum controller for each motor. These small drums are also mounted on the benchboard. They are installed on the horizontal portion of the board directly behind the handles of the main drum controller.

As auxiliary equipment the control includes a pair of bridge position indicators, which are of the Selsyn type. Pilot lights in conjunction with the limit switches indicate whether the bridge is fully open or fully closed and also whether the gates are open or closed. A switch is provided on the benchboard for handling the emergency brake and a set of momentary contact switches is provided for operating the various bells and horns which are used as warning signals. Two cutout switches similar to those commonly used in connection with elevator control equipment are provided to enable the operator to bypass the safety interlocks in emergency. Normally it is impossible to raise the bridge with the gates up. If for some reason it is desirable to bypass these interlocks and have both the gates and the bridge up at the same time, the operator can do so by breaking the glass cover of the emergency cutout switch and depressing the switch. The board also includes a test switch and there is a corresponding test light mounted on the control panel. With his equipment the operator is enabled to test for grounds at any time. The board also includes a voltmeter switch and a set of control switches for the lights used in the operator's house, on the gates, for navigation purposes, signals, etc.

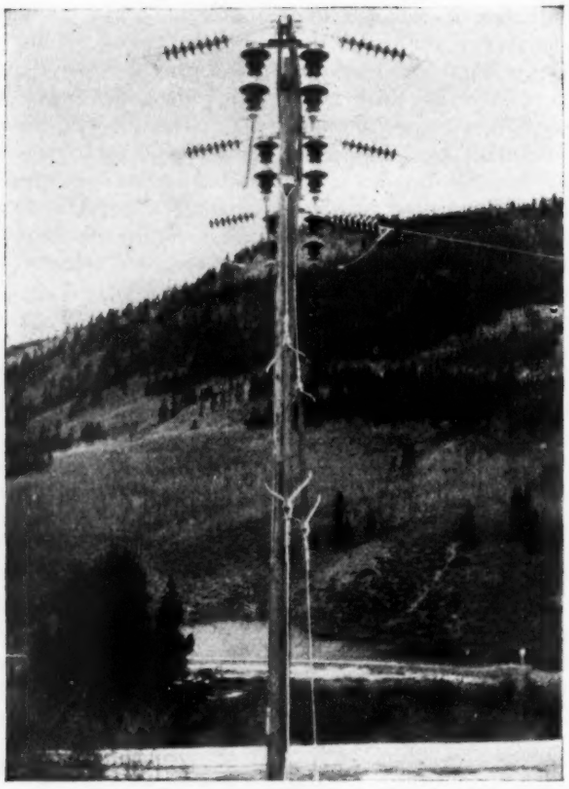


Control Panel and Benchboard for Dorchester Bay Bridge

Note accessibility of benchboard circuits and equipment.

Rocky Mountain

Climatic and topographic conditions favor ungrounded wood pole structures rather than steel towers. Trussed cross-arms require special hardware. Lightning hazard is low



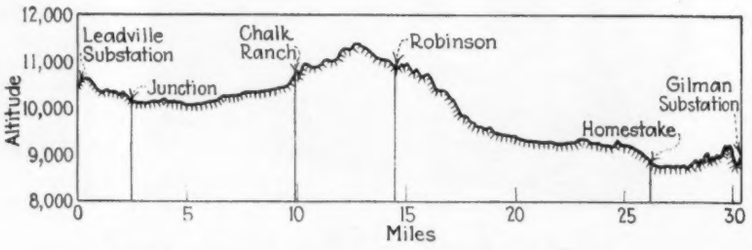
Non-Clearance Sectionalizing Switch Structure

Note wood insulators in guys.

IN SPITE of the accumulated experience of recent years, there yet remain some conditions in which ungrounded transmission-line structures of high inherent insulation value—wood poles with unbonded hardware and no ground wires—are best from an operating standpoint: One such condition is illustrated by a 90-kv. line recently constructed and put into operation by the Public Service Company of Colorado.

This transmission line, which is located in the heart of the Rocky Mountains, begins at Leadville, Colo., and terminates at Gilman, Colo. It is 30.4 miles long and extends across the Continental Divide. The country is a rough mountain wilderness of sharp, rocky cliffs, high peaks and deep, precipitous canyons. The lowest altitude is 8,724 ft. above sea level and the highest is at Fremont Pass, on the Continental Divide, an altitude of 11,289 ft. In such high altitudes the climatic conditions encountered are different from those met with at lower altitudes. The season that holds sway is winter, and it reigns supreme. The precipitation is invariably in the form of snow, which forms in deep drifts. Snowslides frequently occur. These are of such force and magnitude that they sweep everything before them, therefore it is absolutely essential that snowslides be anticipated and their courses avoided, if the transmission line is to operate successfully. Snow may collect on the conductors to some extent, but it will not be heavy and usually blows off. Temperatures will reach as low as —50 deg. F. This is not just an occasional occurrence, but can be expected at any time during the winter. Winds reach very high velocities, but are not cyclonic. In the summer there are some rains, in the nature of quick showers accompanied by lightning. The lightning is apparently not the vicious type which is experienced in some parts of the country.

With all these adverse conditions, there are two climatic factors which are favorable to the use of wood for transmission lines. The first is the absence of sleet, and the other is the dry climate. A sleet storm has never been experienced in this country on any existing lines, some of which are twenty years old. There is a heavy frost which collects in large quantities, but it is not as heavy nor does it cling as tenaciously to wires and structures as ice, and it does not give any trouble. It may appear a paradox to say the climate is dry considering the snows, but the fact is that the snow is quite dry until it melts off in the early summer. During the most of the time the humidity is very low and moisture evaporates very quickly. The low humidity and high altitude give the wood a natural vacuum treatment which is ideal for long life. Wood mine buildings, which are 50 years old and have never been painted or treated, are still standing and in relatively good condition, although they have not been occupied for many years and no maintenance has been done on them.



Profile of Leadville-Gilman Line of the Public Service Company of Colorado

These climatic and topographic conditions give rise to some operating problems which are somewhat unusual and which must be carefully considered in the location and design of a transmission line. Much of the line is on unoccupied land; there are very few roads which

Line Construction

By L. M. ROBERTSON
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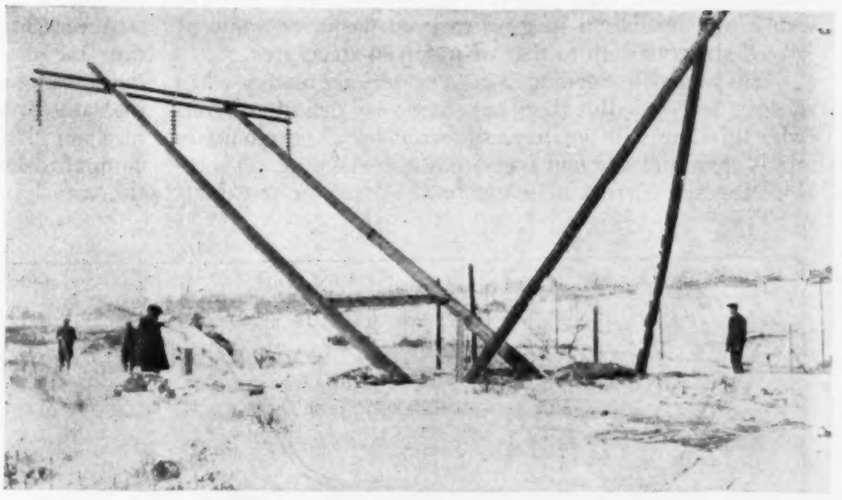


A Shear Gin Was Used to Raise the Assembled Structures

are good, and only parts of them can be kept open during the winter. Therefore, the major part of the patrolling is done on snowshoes or skis. During blizzards it is foolhardy to attempt even to start out. Reliability must be given careful consideration and sectionalizing switches must be installed at points of greatest accessibility to facilitate line testing to isolate a faulty section. If the failure should be the destruction of a structure due to a landslide or snowslide it would make no difference whether the structure were a steel tower or a wood-pole frame. Our experience with steel towers under such conditions has proved that practically no man-made devices will stop avalanches. The only way to avoid such outages is to keep out of the path of slides. But if a failure should take place, it can be repaired quickly and easily if wood is used, because the materials are always available and can be transported and erected rapidly. In fact, temporary replacements of steel towers are always made with wood structures.

Another important factor in the use of wood is the electrical problem. This company has observed the operation of lower voltage lines in similar country, and the conclusion has been reached that wood, in high altitudes where humidity is low, has some decided advantages over steel from the electrical standpoint. The insulation value of wood has long been recognized, but no tests have been made to evaluate the various structural configurations and arrangements. Therefore, investigations were made to determine what the values are. Wood-pole H-frames were set up and tested using wood crossarms and seven 10-in. cap-and-pin insulators in a string. The result of impact tests are as follows:

		Kv.
1.	Ground wire down each pole and hardware grounded	580
2.	No ground wire down poles, hardware bonded together	800
3.	Ground wires down poles, hardware not bonded	1,150
4.	No ground wires, hardware not bonded (over)	1,700

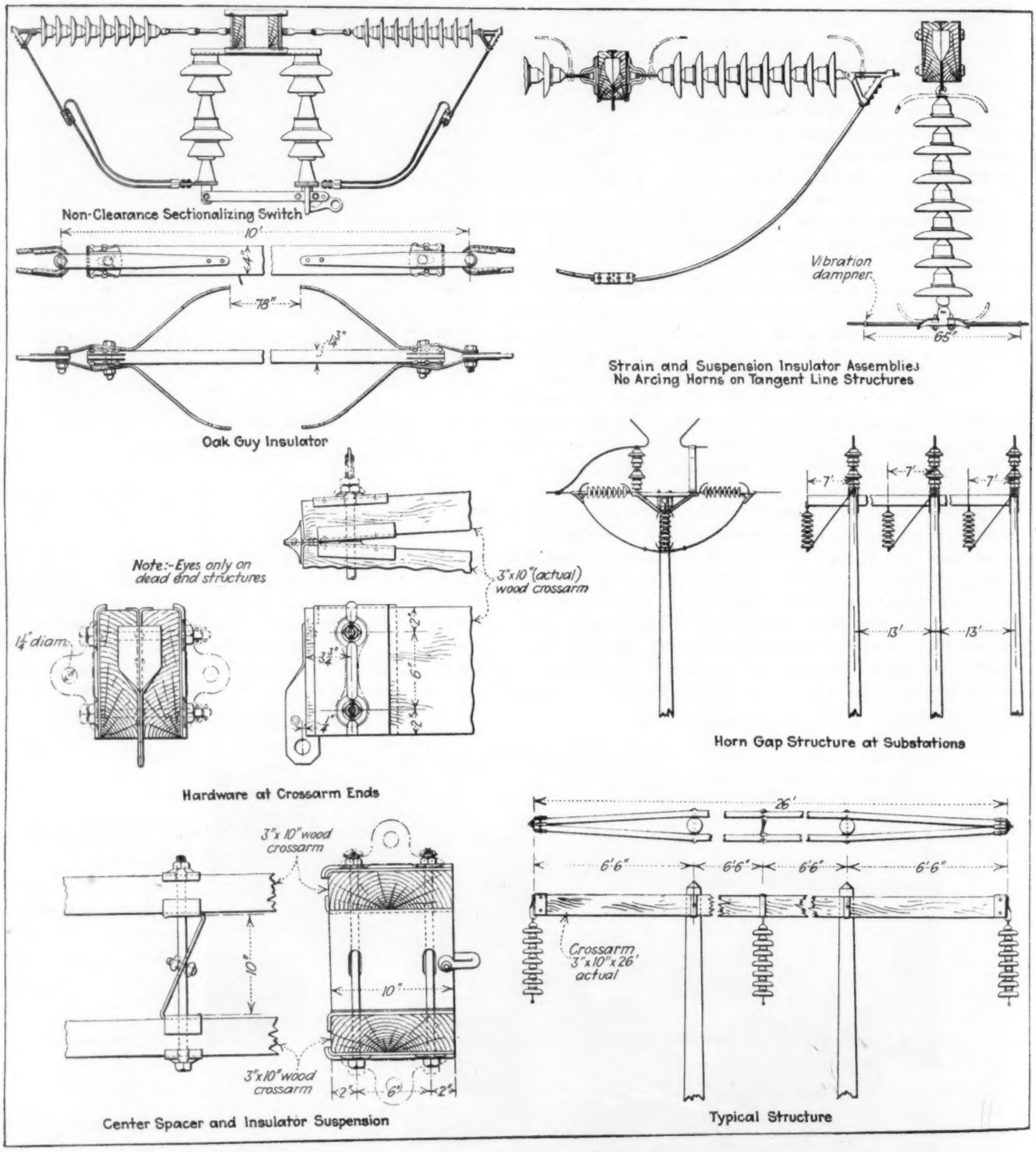
This indicated the value of an all-wood structure without grounds or hardware bonds. The objection to this sort of arrangement is that it lays the structure open to pole shattering. Experience shows that this would result if the line were in flat open country or in exposed positions. However, this line has not been placed on the extreme mountaintops, but instead it is sheltered by high peaks; also, there were no trees along the route which had been shattered by lightning. It was decided to use all wood, ungrounded structures over a route carefully

Fording the Arkansas River with 14 Tons of Cable and Crossarms

chosen with regard to lightning probability and to use ground wires and hardware bonds only for a distance of one-half mile adjacent to substations to protect station equipment from voltages in excess of the safe limit. With this decision reached, there were some other matters which required study. One was arm burning and the other was insulation in guys to keep flashover value of guyed structures up to that of unguyed structures.

Arm and pole burning is a very serious matter when it does develop. But there are some very definite reasons why this line will not have this trouble. The mountain air is clear and dry and free from salt and dust. Therefore leakage current of insulators is small. These facts have been definitely proved on other lines. There are lines in Utah operating at 130 kv. which are of similar construction but have overhead ground wires and ground wires down the poles, but the hardware is not grounded nor bonded together. No trouble has developed on these lines from arm burning except near the Great Salt Lake.

A very important feature which has been incorporated into the design of this line is the use of arm plates developed by the Ohio Brass Company which provide insulator attachments and arm bands, as well as greater mechanical strength. (This is the first line on which this equipment has been used.) These plates practically band the arms at the poles and at the points of insulator



Details of Structure and Insulator Assemblies

attachment. By providing this relatively large area a concentration of leakage current at bolts is avoided and the current density through the wood is reduced. This also aids in preventing burning. The plates have been designed to give better electrostatic characteristics to the pole top and increased mechanical strength. The strength is obtained by using two crossarms and pulling the ends together, thus forming a truss. By doing this the need of crossarm braces is eliminated and the strength of the truss is more than ten times that of the two arms acting as cantilever beams.

Steel plates are placed between the arms at the ends. These plates have teeth which project into the wood and thus assist the bolts in maintaining a solid end assembly. The accompanying drawings show the hardware and constructional details.

A Lengthy Guy Insulator

With the poles and arms arranged for the omission of bonds and grounds, the question of insulation in guys is presented. This was solved by the use of wood insulators 10 ft. long. These were made of creosoted oak timbers 2 in. x 4 in. and provided with arcing horns on the ends. The strength of the wood is developed at the hardware connections by means of an ingenious fitting which is made up of wedge clamps and a bolt which is slightly bent. The manufacturer's tests indicate that the insulators will develop a strength of 24,000 lb., which is ample for the ½-in. guy wire used on this line, which has an ultimate strength of 11,000 lb.

Crossarms were not given any preservative treatment and are rough, full-size 3-in. x 10-in. x 26-ft. Douglas fir timbers. The poles which were used were Western red cedar and were purchased on Western red cedar specifications. They had been given a butt treatment. The conductor is No. 3/0 A.C.S.R. The rugged nature of the country provided opportunity to go to long spans in many places. The longest span is 2,037 ft. and the average is 828 ft. The maximum limits assumed in designs were ¼-in. ice at 0 deg. F., with an 8-lb. wind; also —50 deg. F., no ice and no wind. Experience shows that there is neither wind nor snow at —50 deg. F. At 11,000-ft. altitude the air density is quite low and a wind pressure of 8 lb. represents an extremely high velocity. Therefore, these design conditions are considerably more severe than at sea level. Conductors were sagged so that the maximum tension per wire would be 4,000 lb. under the assumed maximum loading. This is close to the elastic limit and vibration dampeners (developed by the Aluminum Company of America) were used at suspension clamps. These vibration dampeners, which proved satisfactory, consist of aluminum rods placed over the conductor at the suspension clamp and projecting some distance beyond. The ends of rods are fixed to the conductor by means of a doughnut clamp.

Although station type lightning arresters were hardly justified, it was thought advisable to provide more protection to substations than merely bonding the pole and arm hardware and grounding it. Consequently a structure was designed with horn gap to ground. The gap is set to flash over at a voltage which is safe for the station equipment. These structures are set at the substations.

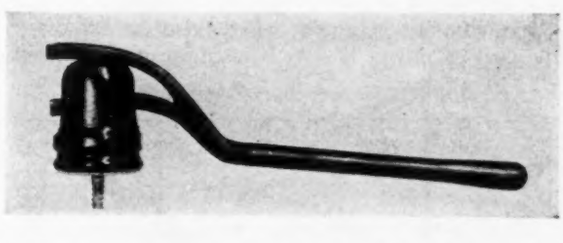
Two types of switching structures were designed, one where gang-operated, air-break switches are used and the other where stick-operated switches are used. Each gang switch is set on a rigid steel frame which is supported by three poles. If the frame is not rigid it is impossible to keep the switches in alignment, and this is essential. The gang switches are used at substations and places where line clearances will be given. Line grounding switches are incorporated into them. Where an occasional sectionalizing of the line is necessary for testing, a switching structure of wood is used. The switch is a 73-kv. disconnect, but insulated for 110 kv. This is used merely to isolate sections of the line for testing and is not used to give clearances.

The Pioneers Also Forded the Arkansas

Construction methods and difficulties encountered in building lines in the mountains are very interesting. There is usually a certain amount of road building which must be done. The length of time when work can be done is so short that jobs must be carefully organized and material must be on hand at the correct time. Machinery can help greatly. Most of the pole holes were in rock. This required shooting them out and an air compressor and air drills expedited the work. The transportation of material over bad roads and steep grades requires trucks, tractors, horses and men. Many bridges were not able to carry heavy construction equipment and the truck and its load of 28,600 lb. shown in the accompanying illustration had to ford the Arkansas River. In order to get material to some locations horses were required.

The conclusions which can be drawn from the construction and operation of this line to date are: (1) No arm or pole burning has developed; (2) cost is considerably below that of steel tower construction under these circumstances; (3) no conductor vibration has developed; (4) line has passed through one winter with temperatures as low as —46 deg. F., and no up-strain or failures have resulted; (5) the new crossarm hardware just developed and used on this line for the first time is very effective and provides a stronger and more rigid structure than any other means yet advanced; (6) lightning season has not yet tested out the insulation, but no flashovers have occurred; (7) assembling H-frames on the ground and raising them into place by shear legs is cheap and fast.

Insulator Wrench



THE familiar service insulator, which is attached to the side of a building by a lag screw cemented into porcelain, is rather awkward to install with any of the ordinary tools of the lineman. George Green, service foreman of the Commonwealth Power Company at Kalamazoo, Mich., has made a special wrench for attaching these insulators. It does the work in one-third the time and with much less insulator breakage than any other tool heretofore used for the purpose, according to the *AuSable News*, and it can be applied to the insulator in several ways. It has been in use for some time in the Kalamazoo district of the company, where it has proved very satisfactory.

High-Frequency Tools Reduce Maintenance

OPERATION of portable tools on high-frequency (180-cycle) power has several outstanding advantages, according to C. B. Coates, electrical engineer of the Chicago Pneumatic Tool Company, who presented a paper before the A.I.E.E. recently. Among the advantages are:

Greatly increased power for the same weight, due to the higher loaded speeds of the rotor.
Reduced weight for a given power output.
Practically constant speed at all loads (8 per cent to 10 per cent slip), which accomplishes more work.
Greatly reduced maintenance costs.

One of the outstanding examples of the advantages of high-frequency tools is to be found in the portable grinder and buffer. The cutting wheel can be operated at the proper and most efficient speed without having to allow a high and dangerous free-speed, as is the case with other types of electric and some air grinders. The wheels themselves give practically double the life at the sustained speeds.

Sustained correct speed also gives long life to reamers and drills. A striking example of the effect of nearly constand speed in increasing the life of the reamer was observed in a bridge fabricating plant with a 50-lb. high-frequency tool having a synchronous speed of 30 r.p.m. The holes were punched $\frac{11}{16}$ in. and reamed to $\frac{15}{16}$ in. through assembled plates varying in group thickness from $1\frac{1}{4}$ in. to $3\frac{3}{4}$ in. More than 3,000 linear inches of this reaming was done with one reamer without regrinding. This was at a reaming rate of 3.7 in. per minute, including the time of changing from hole to hole. Working on deck plates, on ship work, a high-frequency reamer of 300 r.p.m. synchronous speed reamed 100 $\frac{15}{16}$-in. holes in nine minutes, which was 39 per cent faster than with a compound-wound d.c. reamer weighing 40 per cent more.

High-frequency drills selected to give the proper speed for the size and nature of the holes will do the work in one-half the time required by the d.c. or universal drills with their greater speed variation.

In grinding steel bars it was found that the high-frequency grinder removed $12\frac{1}{2}$ per cent more metal, over a period of several days, as compared with equal weight pneumatic grinders of the piston type.

The cost of power is somewhat more due to the transformation to the high-frequency current, but the individual efficiency of the tools is higher than in the old types of tools. As the cost of current in many industries is only about one-twentieth of the cost of production labor, the great increase in productive capacity made possible by the high-frequency tool compensates many times for the slight increase in cost of current.

Sign Service Acknowledgment

By C. R. Tracy
Sioux City Gas & Electric Company, Sioux City, Iowa

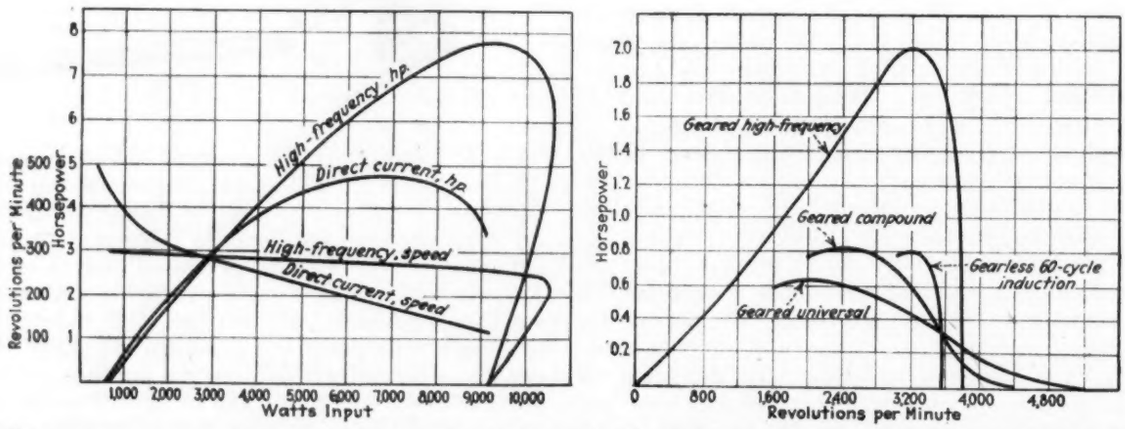
TO BE appreciated a service must be recognized as such. Through experience in its sign maintenance bureau, by which organization electric advertising displays are kept in their pristine brilliance and effectiveness, the Sioux City Gas & Electric Company has learned the value of letting the customer know when work is done for him. Impressed with the load-building opportunity offered by electric signs, the company has fostered this class of business and one means utilized is the extension to sign owners of maintenance service by yearly contract. As indicated by the accompanying acknowledgment card, the service includes replacement of lamps, maintenance of flashers and time clocks and washing and painting the signs. When one of these operations has been performed the service man checks off the work done and the customer signs the acknowledgment. By this means the customer knows that the company is fulfilling its part of the service contract and the company has a record of that fulfillment which is recognized by the customer.

Date.....19..

SIOUX CITY GAS & ELECTRIC CO.
SIGN MAINTENANCE BUREAU
YOUR SIGN HAS JUST BEEN INSPECTED

.....Burned Out Lamps Have Been Replaced
.....Your Flasher Has Just Been Inspected and Oiled
.....Your Sign Has Just Been Washed
.....Your Sign Has Just Been Painted
.....Your Time Clock Has Just Been Wound
.....

Approved:
Customer..... Per.....



Horsepower and Speed Characteristics of High-Frequency and Direct-Current Reamers and High-Frequency Grinder Compared with Three Other Types

Relative Hazards of the
Conduit-Return Wiring System*

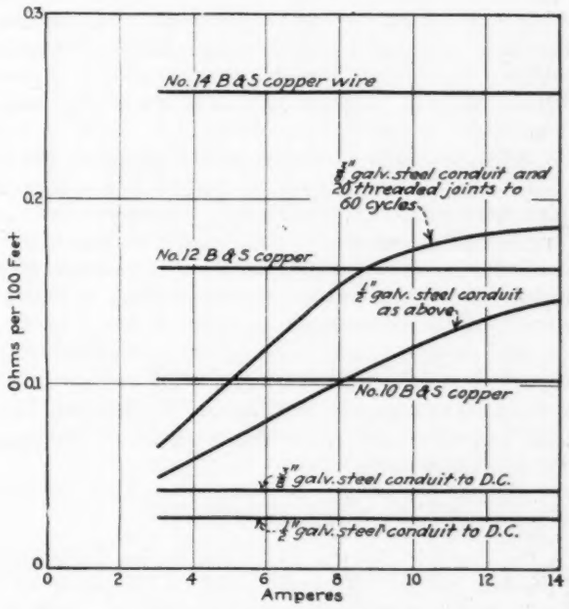
Tests of conduit and joints support claim of adequate control of life and fire hazard

By Edward Bennett
Professor of Electrical Engineering University of Wisconsin

A COMPARISON of the effective resistance of the proposed conduit returns with the Nos. 14, 12 and 10 B & S copper wires which are now being used as the grounded return conductors of branch circuits is contained in the accompanying illustration. The curves show the relation between the effective resistance of a 100-ft. length of return conductor and the current which the conductor carries, the temperature of the conductor being taken to be constant at 25 deg. C.

The resistance of the copper wire returns to alternating or to direct current and likewise the resistances of the conduit returns to direct current do not vary with the current, but this is not true of the effective resistance of the steel conduit returns to 60-cycle alternating current. The 60-cycle alternating current in the conduit return is not uniformly distributed over the cross-section of the conduit, but, by reason of the skin effect, the current density along the inside surface of the conduit may be twice as great as the mean current density in the conduit, while along the outside surface of the conduit the current density may be only one-half as great as the mean. The greater the magnetic permeability of steel the greater is this variation in current density from inside to outside, and consequently the greater is the expenditure of energy in the conduit and the higher is the effective resistance of the conduit. Now the magnetic permeability of the steel is not a constant, but it increases as the magnetizing current carried by the insulated conductor is increased from the light load values of 1 amp. to the maximum permissible branch circuit value of 12 amp. Consequently the effective resistance of the $\frac{3}{8}$-in. and the $\frac{1}{2}$-in. steel conduits to 60-cycle currents increases with the current in the manner shown by the curves. These resistances were calculated from measurements of the watt expenditures at different currents in a loop consisting of a No. 12 B & S R. C wire drawn in a 100-ft. length of conduit made up of ten 10-ft. lengths of galvanized conduit joined by threaded couplings, the conduit acting as the return conductor.

Some of the results shown by the curves have been put in tabular form in the accompanying table. Referring to this table or to the curves, and taking the resistance of 1 ft. of No. 14 wire as the standard of comparison it will be seen that the resistance of a foot of $\frac{1}{2}$-in. conduit to direct current is only one-tenth and to 6-amp. alternating current it is only one-third of the resistance of the foot of wire which it may replace. The resistance of the $\frac{3}{8}$-in. conduit to direct current is only one-sixth and to 6-amp. alternating current it is only one-half of the ressistance of the foot of No. 14 wire.



Effective Resistance of Conduit Joints and 100-ft. Lengths of Conduit

Resistance of Threaded Joints

The resistances given above for conduit include the resistance of the twenty threaded joints in the 100-ft. length of conduit. To determine the resistance in the threaded joint between a conduit and a coupling measurements were made on lengths consisting of ten short $\frac{1}{2}$-in. pipe nipples joined by threaded couplings.

The results of these measurements are given in the accompanying table. It will be noted that the resistances are given for four conditions, namely, for bright threads —that is, threads recently cut, with hand-tightened and with wrench-tightened joints—and for rusted threads tightened first by hand only and then with a wrench. In the case of the rusted threads the nipples and couplings were allowed to rust in a sink for six weeks before

*Final installment of Professor Bennett's paper, "The Steel Conduit as One Conductor in Branch Lighting Circuits," presented at a recent meeting of the Electric Section of the Wisconsin Utilities Association.

they were screwed together; they were rusted to such an extent that in many cases it was only possible to cause the nipples to enter the couplings by one thread when tightened by hand alone.

It will be noted that the resistance of a joint from conduit to coupling made by screwing together a rusted nipple and coupling is less than the resistance of 1-in. of No. 14 wire. The effect of using the wrench on a hand-tightened joint is to cut the resistance to one-half the hand-tightened value.

In all the measurements made by the writer on old and new conduits he has never encountered a threaded joint having a high resistance.

Resistance of Link Joints

As previously stated, the writer advocates that in the conduit-return system the conduit entering any outlet box should be bonded to the conduit leaving the box by a No. 14 B & S copper link which is located inside the outlet box and is clamped between a locknut and a bushing screwed on the end of the conduit on the inside of the box. In parallel with this link joining the conduits is another conductor, namely, the metallic box itself, which is clamped between two locknuts on the end of each conduit.

To determine the resistance of the clamped joint or contact from the conduit to the copper link many pipe nipples were connected in series by the copper links and the resistances measured. The result is listed at the foot of the accompanying table. The resistance of the clamped joint from conduit to copper link is equal to one-tenth of the resistance of a foot of No. 14 wire.

Comparison of Hazards

It remains to compare the life and fire hazards of the conduit-return system with the hazards of the customary conduit system:

(a) Under Normal Operating Conditions, Alternating Current:

In the conduit circuits using the copper wire return the conduit carries no current and is connected to the ground, consequently the whole length of conduit is normally at ground potential.

In a ½-in. conduit-return circuit 100 ft. in length carrying 6 amp. throughout the entire length the voltage between the far end and the panel end of the conduit is 0.16 volt for direct current and 0.11 volt for 60-cycle current. In three-wire alternating-current interior wiring systems the grounding conductor is not connected to the neutral wire at the distributing panel but to the line side of the service switch. If this service switch is some distance from the distributing panel, the voltage drop in the neutral conductor from the distributing panel to the ground connection at the service switch will not exceed 0.2 volt at time of full load. Consequently at time of full load the voltage between the most remote point of the longest branch circuit conduit and ground will not exceed $0.11 + 0.20 = 0.31$ volt.

We conclude that on alternating-current three-wire distributing systems under normal conditions nothing can be said for or against the conduit-return system in comparison with the customary conduit system on the score of hazard.

(b) Under Normal Operating Conditions, Direct Current:

In direct-current three-wire networks the National Electrical Code requires that the neutral shall be grounded at one or more supply stations, but *shall not* be grounded at individual service entrances. Therefore, in a building supplied from a city direct-current network, if the branch circuit conduit is connected to the neutral at a distributing panel, the panel end of the conduit will differ from ground potential by the drop in the neutral service wire, neutral main and neutral feeder back to the supply station. At time of full load this drop plus or minus the 0.16 volt to the far end of the loaded 100-ft. run of branch conduit will not constitute a life hazard. If the conduit is in imperfect contact with ground it may cause a fire hazard and may give rise to objectionable electrolytic action. Consequently the use of the conduit-return system in buildings served from city three-wire direct-current networks is a questionable matter as long as it is found to be, or deemed to be, inadvisable to ground the neutral at the individual service entrances.

(c) With Break in Branch-Conduit Run:

In conduit-return systems using the copper wire as the return conductor, if any portion or section of the metal raceway of a branch circuit becomes disconnected from ground, and if the ungrounded conductor of the branch circuit comes into metallic contact with this ungrounded portion of the conduit, then the voltage from the ungrounded portion of the conduit to ground becomes 110 volts. This may constitute a life and fire hazard, but the lights and appliances continue to operate at full voltage and nothing occurs to give any warning.

On the other hand should a break occur in the grounded conduit return of a branch circuit the voltage between ground and the conduit on the ungrounded side of the break would become 110 volts upon turning on the branch switch which controls the lamps or appliances connected to the conduit beyond the break. This may constitute a life and fire hazard, but the hazard makes itself known and must be removed before the lamps or the appliances beyond the break will operate at all. Suppose a joint in the grounded conduit return of a lighting circuit is imagined to have a resistance such as to cause a drop of 10 or 15 volts in the conduit. This would not constitute a fire or a life hazard, but such a high-resistance joint would make its existence known by reason of the dimness of the lamps or the unsatisfactory performance of the appliances.

(d) Under the Loss of All Connection to Ground:

Suppose the wiring in the building becomes entirely disconnected from ground by reason of a break in the ground connection and a break at some point in the

Resistance of Branch Circuit Conductors

	Micro-ohms
No. 14 B & S copper per foot	2,580
No. 12 B & S copper per foot	1,620
No. 10 B & S copper per foot	1,020
½-in. galvanized conduit per foot:	
To direct current	420
To 60 cycles a.c. at 3 amp.	650
To 60 cycles a.c. at 6 amp.	1,200
To 60 cycles a.c. at 12 amp.	1,720
¾-in. galvanized conduit per foot:	
To direct current	270
To 60 cycles a.c. at 3 amp.	500
To 60 cycles a.c. at 6 amp.	800
To 60 cycles a.c. at 12 amp.	1,360
Threaded joint ½-in. conduit to coupling:	
Bright threads (hand tightened)	140
Bright threads (wrench tightened)	70
Rusted threads (hand tightened)	310
Rusted threads (wrench tightened)	155
Joint, conduit to copper link	240

Merits of the System

The conduit-return system is distinctly superior to the customary steel conduit system of wiring which uses a copper wire as the return conductor in both the matter of lower resistance and lower cost.

Of two circuits each of the same length and each carrying 6 amp. at 60 cycles, the resistance of the circuit using the $\frac{3}{8}$-in. conduit as the return conductor is only 73 per cent of the resistance of the circuit using a No. 14 copper wire as the return. For the same percentage drop the conduit return circuit may be 50 per cent longer than the standard two-wire circuit.

The conduit-return circuits are not only lower in resistance than the customary conduit circuits to the extent stated above, but the cost of the conduit and wire for the conduit-return circuits will be approximately 20 per cent less than for the customary conduit system and there will be a further saving in the cost of labor.

The annual saving in the United States which would result from the general use of the conduit-return system in place of the customary rigid conduit system has been estimated to be $3,600,000 in materials alone.

The hazards in the conduit-return system are substantially the same as those in the customary conduit system except in two situations where the use of the conduit-return system is questionable. These two situations are (1) on direct-current networks in which the neutral may not be grounded at the service entrance, (2) on alternating-current distributing systems in which a low-resistance ground cannot be readily obtained.

neutral main or in the neutral service wire. Then the lamps connected beyond the break in the lightly loaded half of the three-wire circuit will all burn out, the neutral wire and the branch circuit conduit connected to it beyond the break will rise to the potential of the outside wire on the heavily loaded side and the lamps on this side will receive no current and will give no light. This loss of ground (an extremely remote possibility), which may result in raising the branch conduit of both the customary system and the conduit-return system to 110 volts from ground, makes this hazardous condition known in both systems and neither system is superior to the other on the score of hazard.

(e) With a Break in the Neutral Service Wire:

If a break occurs in the neutral service wire and if the neutral main and the conduit remain connected to the same ground (the water piping system), within the building, the neutral main and all the conduit system will differ from ground potential by an amount which depends jointly upon the amount of unbalanced current which must flow to the transformer neutral by way of the piping system and the resistance of this ground path. If the unbalanced current and the resistance are both high, the voltages between the two outside conductors and neutral become badly unbalanced and the lamps may burn out as in the previous case. Neither system is superior to the other under these conditions.

(f) With a High-Tension Line Crossed with the Secondary Distributing System:

If a high-tension, heavy current line becomes crossed with or connected to the alternating-current three-wire secondary distributing system it may blow the fuses in the ungrounded mains and in the ungrounded conductors of the branch circuits if the fault causes excessive current to flow through these fuses. This still leaves the high-tension line connected to the house wiring and to the conduit system through the neutral service wires and mains. If the high-tension circuit is not automatically cut off, but continues to supply current through the neutral conductors of the distributing system to ground, the neutral conductors and the conduit systems in the building differ from ground potential by a voltage which depends upon the resistance of the grounds and the magnitude of the fault current. The hazard is the same on both the conduit return and the customary conduit systems provided the conduit and the wiring are grounded to the same underground water or gas system.

In situations in which artificial grounding electrodes must be used, the hazard in the event of a high-tension fault to the distributing system is somewhat greater for the conduit-return system than it is for the customary conduit system in which the conduit system and the wiring system are connected to different artificial grounding electrodes. This is particularly true in situations in which it is impossible to obtain and maintain artificial grounds of low resistance. Consequently it is questionable whether the conduit-return system should be used under the following conditions:

1. Neither a water system, a gas system, nor a system ground conductor is available for grounding purposes.
2. It is impossible to obtain and maintain artificial grounds of low resistance.
3. There is the likelihood or the possibility of a high-tension fault to the three-wire secondary distributing system to which the building is connected.

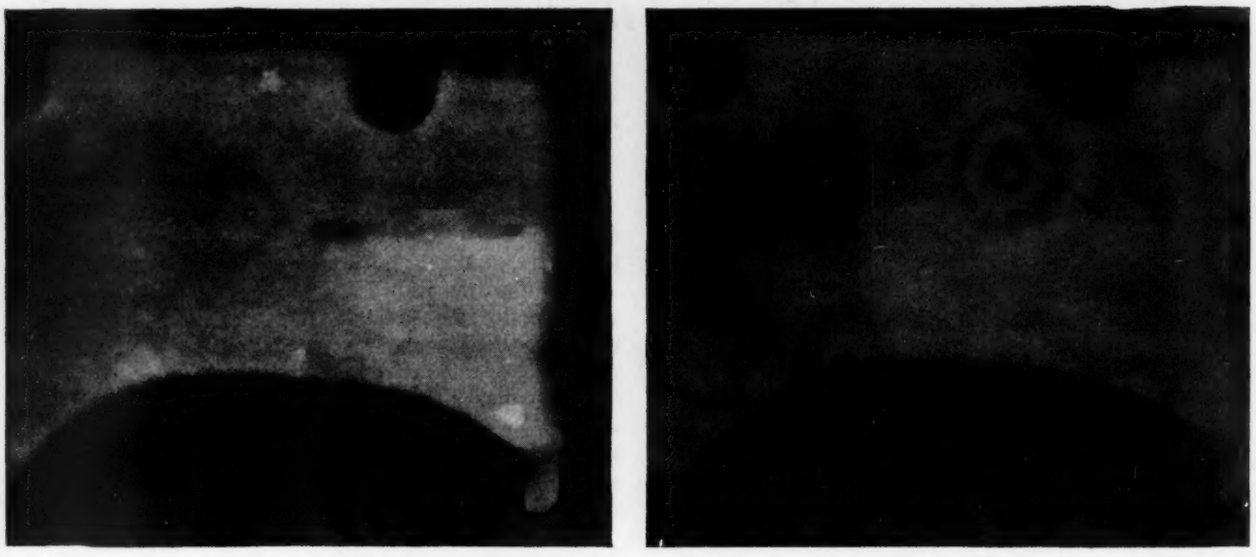
Burning Street Lights All Night Best for Cities

CONTRARY to the accepted belief, it is often more economical for a city to allow a two-light electrolier to burn all night than to pay interest, maintenance and depreciation on the equipment necessary to switch one light off at midnight. This is indicated by the experience of the Pacific Gas & Electric Company.

If the switching off of one light of a two-light job is to be accomplished, it requires the installation of a separate series transformer in the base of the post, also an extra wire in the circuit for which a conduit of larger diameter must be installed. Assuming the average distance between electroliers to be 125 ft. and the lamps of approximately 600 cp., the transformer to be type IL or equal, with terminals for sweating, the installation cost per electrolier on this basis will be about as follows:

6,000/10,000 lumen series transformer, plus installation	$21.25
Extra wire, extra-size conduit, and extra labor	22.75
Total extra cost per electrolier	$44.00

X-Ray Inspection of Castings



X-Ray Photos of Aluminum Castings

The figure at the right shows an acceptable condition of homogeneity, while the one on the left discloses pronounced flaws justifying rejection.

THE Aluminum Company of America is using X-rays at its sand foundry in Fairfield to verify the homogeneity and freedom from flaws of aluminum alloy castings. In the case of important products every casting is subjected to X-ray test before it passes inspection. In other pieces of product key samples are X-rayed and the plates examined for flaws in the individual casting. Exposures run up to six or eight minutes for average pieces of product and it is calculated that $1 is the approximate cost of one print.

Interest and depreciation on the above $44 amounts to $7.33 per year, or 61 cents per month; this as against the saving of only 44 cents per month in the rate which is this company's charge for lighting at ¾ cent per kilowatt-hour after 12 o'clock midnight. In addition, some one must maintain this additional equipment. On any reasonable difference in spacing between posts it is thus seen that it is much better that the city light all lamps all night than to pay the investment depreciation and maintenance charges on the extra transformer and material to accomplish the switching at midnight.

Insect Raising Offers Field for Electric Heating

ENTOMOLOGISTS in the agricultural department of the State of California and engineers of the Southern California Edison Company have developed a new use for electric heat which holds promise of an excellent central-station load. Orchardists and growers of all types of vegetables have long had difficulty with an insect known as the mealy bug. In some localities this bug has become a very serious menace. In attempting to devise means of combating this insect, it was discovered that the small *Cryptolæmi,* commonly known as the ladybug, lived almost exclusively on the mealy bug. With this as a basis, a plan was decided upon to make ladybugs available in large quantities for the agriculturalist.

In the development of this program carefully ventilated rooms were built, 18 ft. long by 8 ft. wide by 8 ft. high. In these rooms two tiers of racks were placed and upon these are placed shallow trays, 15 in. square by 5 in. deep. It is customary to have about 150 of these racks to the room.

It is essential that the temperature in these rooms be under absolutely accurate control. Several installations for this type of ladybug culture have been in operation in California, using gas or oil, but due to fire hazard and the difficulty of maintaining constant temperature, electric heat is rapidly coming into favor. The electric heating equipment for each room consists of eight ½-kw. heaters of the industrial black heat type. The large number of heaters makes possible an absolutely uniform temperature throughout the room. An automatic thermostat permits a variation in temperature of less than 2 deg.

There are three distinct periods in the process of raising the ladybugs. The trays are first filled with potatoes imbedded in moist soil suitable to producing sprouting. The room is then held at a temperature of 70 deg. for three weeks. With a good crop of potato sprouts ready the second or infesting stage in the process begins. A few mealy bugs are freed in the warm room and the temperature raised to 80 deg. and held there for two weeks. The mealy bugs multiply at an astonishing rate and by the end of two weeks practically the entire crop of sprouts has been devoured by the ever-increasing horde of mealy bugs. Then the third stage begins. A number of ladybugs are freed in the room and for the next seven weeks the temperature is maintained at 75 deg. These few ladybugs with the vast number of mealy bugs to be eaten multiply rapidly. At the end of the seven-week period the ladybugs are captured and placed in capsules, ten to each capsule. The capsules are then sent out to the agriculturalists and the ladybugs freed in the orchards to combat the mealy bug menace, about ten ladybugs per tree being required.

From the standpoint of the central station, each warming room represents a load of 4 kw. in operation 24 hours a day for a full twelve-week period for each cycle of ladybug development. Each incubating room has a capacity of approximately 125,000 ladybugs per twelve-

week cycle. Fifteen county citrus associations and privately owned insectories are now engaged on a commercial scale in the production of this ladybug *Cryptolæmi.* Present estimates indicate that approximately 4 cents per insect is being spent on this work.

Letters from Our Readers

Mental Lapses Cause Accidents

To the Editor of the ELECTRICAL WORLD:

An analysis of many industrial accidents shows that the new employee is a victim in a high percentage of cases. The reason, presumably, is that he has not been properly instructed, has not been adequately warned and has not become sufficiently proficient at his task. After the new employee, strangely enough, it seems to be that the older employee is more often the victim than those who come in between the new and the old. The reason for this seems to be that he has become careless for the reason that "familiarity breeds contempt."

The situation is somewhat different, however, with electrical hazards, because of the obvious danger of electricity. Where electricity is involved it is rarely the new employee who meets with an accident, because fear is a factor in maintaining carefulness and caution. That the human worker is subject to mental lapses places a still greater responsibility upon the designer of electrical equipment, power stations, etc. In too many instances engineers seem to think that the safety-first movement should start after the plant is in operation. As a matter of fact, safety should be built into the design and should be scrupulously carried out through the construction. A plant that is built safe will stay safe—safeguarded against mental lapses, mistakes, etc. The undersigned, while a road engineer, had the opportunity to study thirteen accidental electrocutions. That was in the days before safety first was practiced or even heard of, before the present-day safety appliances were available, when lineman and wireman were much the same thing.

Of these thirteen deaths from electrocution three were due to "green" men, not familiar with electrical hazards, coming in contact with live circuits. In one instance a laborer drilling a hole through a large stone wall allowed his drill to slide through and come in contact with a 60,000-volt conductor. In another instance, a rigger threw a rope over an I-beam, making contact with a 20,000-volt live circuit, through a copper core of the rope, causing electrocution. In a third instance a painter disobeyed orders and came in contact with a 36,000-volt line. All three of these fatal accidents could have been prevented by an alert foreman and by the formulation of adequate rules, rigidly enforced, none of which existed nineteen years ago on the Pacific Coast.

Of the remaining ten fatal accidents, eight occurred to skilled men, men familiar with every detail of the station in which they were working, men grown old in the service of their company. Of these, six deaths occurred on urgent emergency jobs. This means that in six of these cases the men were concentrating upon their work, that they were thinking more about getting the job done quickly than of safety and danger. Three of them would undoubtedly have been avoided had the worker who was killed been accompanied by a man trained in resuscitation.

Two fatal accidents were caused, supposedly, by a mental lapse during concentration. In both instances the man had no need to hurry, there was no disturbing influence to cause distraction from the job in hand. In fact, the men were making a record of the serial numbers of the various pieces of equipment when they were electrocuted. What they were doing, where they were found and how they happened to come in contact with 40,000 volts was never explained. A mental lapse or concentration upon the job in hand seemed to be the most logical explanations.

It is no longer supposed to be cowardly to be careful. Men no longer take the chances they once did. Bare conductors, crude temporary wiring and absence of barriers, interlocking devices, danger signs and adequate grounding devices are no longer prevalent. Nevertheless, electrocution continues, and the blame cannot be placed upon defective equipment, lack of precautions or unfamiliarity with the work. It has been said that the best safety device is a careful man. Meanwhile, domestic troubles, physical ills, mental worry, haste and familiarity with the job are factors which must be contended with if electrical accidents are to be reduced. Men become callous and then careless. It is inevitable. Meanwhile, the foreman has a heavy responsibility in seeing that his men have their thoughts upon the task, in insisting that all the recognized safety practices are adhered to rigidly and that men who fail to live up to them are punished. There are those who feel that the best way to make a man practice safety is to make him realize that he must set an example to others. There are those who feel, to quote an old Chinese proverb, "one picture is worth ten thousand words." In other words, drive home the tragedy of accidents by true-to-life pictures rather than by long-winded bulletins and notices. Do not satiate the men with lectures. Keep them on their toes. Provide them with all safeguards and precautions. Insist that they act safely, think safely and let them take their time.

Wrigley Building,
Chicago, Ill.

K. RANKIN.

Resuscitation—Lineman or Interne?

To the Editor of the ELECTRICAL WORLD:

The editorial on resuscitation printed in your issue for July 27 and referring to authority over cases in progress is timely and gives emphasis to a situation which has caused the accident prevention committee much concern.

In some cities the police have developed so much confidence in the effectiveness of resuscitation by utility employees that no interference by them need be feared, regardless of authority conferred by statute or local ordinance. That this is not true in all cities is deplorable. So also is the lack of knowledge by internes concerning resuscitation.

In the last two meetings of the accident prevention committee there have been discussions on plans to educate internes and police. Supplies of the joint A.G.A.-N.E.L.A. publication "Resuscitation" have been sent by many utilities to police departments. Further effort along these lines is under consideration by the subcommittee on resuscitation.

On the 1929-30 accident prevention committee program there is a plan to investigate and digest statutes and ordinances through the geographic division organizations. Your suggestion thus has had indorsement in advance by the accident prevention committee.

C. R. BEARDSLEY,
Chairman Accident Prevention Committee.
National Electric Light Association,
New York City.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Recent Progress in Steam-Turbine Plant. — CHARLES A. PARSONS. — Following a historical outline of the development of the steam turbine, the author endeavors to point out the more recent progress in steam turbine design, with particular relation to increased fuel economy and output per unit and the reheating of steam after partial expansion. Improvements in surface-condenser design, progress in high-speed alternator construction, improved steel ingots for large forgings and similar factors have been taken into consideration. A number of illustrative examples have been included in connection with the exposition of the general principles.—*Engineering (England)*, August 16, 1929.

Hydro-Electric Installation at Hammarforsen, Sweden.—The power plant recently erected at Hammarforsen, Sweden, involves a number of unusual features and yet is illustrative of recent hydro-electric engineering in that country. Among the interesting elements are: Hydraulically balanced, but mechanically operated, sector gates of very large size, and the use of a new type of movable needle supports for outlets of great width where unobstructed openings are required. Because of the extreme variation in water levels both above and below the falls special provisions were made. Also worthy of note are the construction methods employed in the placement of concrete and reinforcing steel. A number of details illustrative of construction work and design elements of this modern Swedish plant have been included.—*Engineering (England)*, August 23, 1929.

Motors and Control

Electric Drive of Cloth Printing Machines.—J. ELMER.—Among the great variety of textile machines, those to produce printed cloth or "prints" require the greatest delicacy of power and speed regulation, a fact which is brought about by the almost endless variety of designs, each calling for a best suited printing speed. A regulation between 150 and 1,250 r.p.m. is not an unusual demand. It is for this reason that such machines have rarely been driven from transmission shafts; usually an individual steam-engine drive was found to be the best solution, until more modern installations preferred the electric motor. Direct current and rotor wound induction motors, used formerly exclusively, are neither economic nor do they give more than a rigid number of rather coarse steps in speed. The author claims that the three-phase commutator motor is the most satisfactory drive, since it allows a stepless and always economic regulation of speed within the above-mentioned range. A mathematical method of calculating the power demand for printers and a general description of the drive details are given for this type of motor.—*Brown, Boveri Mitteilungen, August*, 1929.

Generation, Control, Switching and Protection

1,500-Lb. Pressure Steam Plant at Mannheim Power Station.—In the selection of 1,550-lb. steam pressure for a recent German station the factors of location, price of coal, cooling water facilities, size, estimated increase in demand, interconnection with existing stations and character of the ground available were all considered. The reasoning which led to the decision has been indicated and some of the data upon which the decision was based has been included. This is said to be the first installation in Europe, of any considerable size, to utilize 1,500-lb. pressure and an indication of the design selected as well as of the heat flow diagram and various other elements in the situation offers a probable indication of future development abroad.—*Engineering (England)*, August 23, 1929.

Transmission, Substations and Distribution

Performance of Tied Systems. — R. RÜDENBERG.—Germany has now in operation and under construction about 10,000 miles of transmission lines of 60, 100 and 200 kv. The tying of several stations into large national networks is now being undertaken on a considerable scale, bringing up problems of performance under these conditions. The present paper is one of the first European treatises on the subject, going into great mathematical detail of all factors governing parallel operation, load distribution, flow of reactive power, voltage regulation, quarter-wave effect on long lines, system stability, influence of grounds and shorts, etc.—*Elektrotechnische Zeitschrift*, July 4, 1929.

Electric Power System Development. —WILLIAM T. TAYLOR.—A discussion of the factors which must be considered in designing a system for the future, a comparison of European and American practices, an evaluation of safety elements for the public and for employees and an endeavor to develop the concept of a system with a true neutral point. The author has indicated the values involved in changing from delta to star distribution for both the standard system at present in vogue and for one which he advocates. The new system explained in this and following articles will, it is said, overcome many of the commonly known disadvantages and offer standard system voltages by means of a common polyphase unit or three single-phase transformers, convert the wye and the closed delta systems to a symmetrical three-phase, four-wire system using one polyphase unit or three single-phase units and providing a true neutral point from the closed delta circuit, and convert the delta system without changing any of the existing phase relations.—*Electrician (England)*, August 23, 1929.

Units, Measurements and Instruments

Sine-Wave Alternator for Meter Testing.—A sine-wave generator specially designed for the requirements of meter testing has been developed by an English firm and while the alternator is of normal pattern the unit has been devised so that the voltage generator is as near as possible to a pure sine-wave form even with very weak field. The alternators are very much larger than the standard machines of the same output, while the stators are provided with specially pitched and distributed coils, which are wound in skew slots. Coils of the same type are used on the rotor, which is of non-salient design, and the air gap is large. A short-circuited winding is provided on the rotor, thus enabling the alternators to work satisfactorily as single-phase generators. Some of the considerations which must be weighed in the production of such equipment have been pointed out in this discussion. — *Engineering (England)*, August 23, 1929.

Traction

New Method for Quick Measurement of Rail Joint Resistance.—H. F. ZANGGER.—In an endeavor to localize stray currents from poor rail joints of electric street car lines, and to avoid corrosive electrolytic action upon underground pipe lines, the Swiss Railway Commission developed a new, ambulant measuring equipment, capable of accurate measurement of up to 800 joints per eight-hour shift. The equipment gives the resistance of the joint expressed in length of unbroken rail, but instead of the formerly common use of a bridge method, readings are made on two millivoltmeters, one reading the drop along 10 cm. of solid rail, the other of 10 cm. across the joint. The two lengths of 10 cm, are definitely and accurately assured by means of two solidly built contacting devices with sharp edge copper disks. The current supply is furnished by one 300-amp. Edison cell, with a current

of 50 to 100 amp. The complete equipment weighs 830 lb. and requires three men, two for the two contacting devices and one instrument reader. All the necessary instruments are mounted on a spring-suspended board, which is arranged to be placed across the opposite seats of a trolley car.—*Bulletin de l'Association Suisse des Electriciens*, July 7, 1929.

Miscellaneous

Tests on Electric Hot Plates.—J. OPACKI.—It is customary to attribute 85 per cent efficiency to pots with built-in heating units, 90 per cent to immersion heaters and only 80 per cent to hot plates. The author undertook a series of laboratory and domestic tests, and is of the opinion that hot plates, when properly designed and used, can reach 90 per cent and even higher efficiency. A simple method is first described to measure relatively the merit of heating plates by the water evaporation method. Heating tests are then reported, showing, for various market types of plates, the influence of construction, surface, diameter and height of cooking vessel. A perfectly polished surface of plate and pot are of prime requisite to reach maximum thermal efficiency. Pot diameter must also be equal to plate diameter or heat losses are caused, amounting readily to 2 per cent. Much waste of current is caused on most hot plates with two or three heats by requiring too much current on the lowest heat. Frequently it will be found that one-half the wattage of the first step would be sufficient to keep a pot boiling. All of the above test results are given in tabulated and graphic form.—*Bulletin de l'Association Suisse des Electriciens*, July 22, 1929.

Recent Electrical Progress in India.—H. T. COOPER.—The use of electrical energy in India has lagged considerably behind the adoption of mechanical processes and the industrialization of the country. Some of the elements entering into this situation, the probability of future development and certain statistics and information regarding the systems now in use and the horsepower devoted to industrial work have been given.—*Electrician (England)*, August 2 and 9, 1929.

Book Reviews

Die Technik Elektrischer Messgeräte

By Dr.-Ing. Georg Keinath. Munich and Berlin: R. Oldenbourg, Vol. I, Messgeräte und Zubehör, 620 pages, 561 illustrations; Vol. II, Messverfahren, 424 pages, 374 illustrations.

The preface outlines the object: to serve as a reference work for the user of electrical instruments confronted with problems in electrical measurements, who is not critically familiar with current periodical literature on the subject. In this aspect the author, a specialist with a prominent German manufacturing company, seems to have been commendably successful. The style is primarily descriptive rather than theoretical. The present edition, the third, is stated to constitute a thorough revision of the original published eight years ago. Liberal use is made of charts. Emphasis is laid on engineering instruments, as against those used in purely scientific research, omitting forms patented but not used in practice, and excluding also motor types of meter.

Of Vol. I about a fifth is devoted to general considerations: accuracy, ruggedness, judicious choice by the purchaser between necessarily conflicting qualities. Auxiliary equipment, e.g. current and potential transformers, is discussed at some length. Despite their brevity the thoroughly modern sections on inertialess oscillographs and on properties of materials will interest many engineers.

Vol. II includes, aside from the usual electrical measurements, some interesting descriptions of practical, but less generally known, schemes and devices for electrically measuring non-electrical quantities.

Festschrift Prof. Dr. A. Stodola zum 70. Geburtstag

Zurich and Leipzig: Orell Fussil Verlag. 600 pages. Price, $5.

Following the example set so long ago by the students and friends of the late Prof. Dr. Riedler, a group of prominent European engineers, most of them students or associates of Dr. Stodola, have celebrated the attainment of his seventieth birthday by bringing out the above volume of their original technical papers covering a wide engineering field to correspond to the many-sidedness of Dr. Stodola's accomplishments.

While Parsons, De Laval and Rateau were the pioneers in the practical development of the steam turbine, Aurel Stodola studied and taught its theory to many students during the last 40 years, and his work in this line is unique in its treatment of the subject.

The foreword is by Rohn, the president of the Swiss Board of College Education, and this is followed by a carefully considered biography of Aurel Stodola by W. G. Noack. Technical papers by students and associates cover 600 pages of most interesting reading.

Among the names of the contributors one finds: A. Einstein, Föppl, Honegger, Jakob, Kraft, Havlicek, Lorenz, Mollier, Nusselt, Prandtl, Schüle and others, experts in different fields. The articles are extremely interesting by their condensed form, which necessitates an unusually high standard of mathematical treatment. It is by no means easy reading for novices, but for the working engineer there are new ideas on many subjects couched in generalized mathematical expressions.

The question of turbine blading has been dealt with by J. Acheret, Colombi, Darrieus, Dubois, Flatt, Loesel, Seippel. The thermodynamics has been covered by Jakob, Havlicek, Miskovsky, Mollier, Nusselt, Schüle, Zerkowitz. Considerable work is shown on vibration and on strength of turbine parts. Especially interesting is Honegger's paper on thermal stresses. The experimental work on Diesel engines, locomotives, turbines and the internal combustion turbines is also well represented. Huguenin presents a paper on air liquefaction by the Linde, Claude and cascade processes and describes the Toulouse synthetic ammonia plant. The short article by A. Einstein on his new field theory is a beautiful abstraction even for the uninitiated and its outstanding feature is the way this abstraction shows the difference between the scientist's and the engineer's mental tools and the materials on which their efforts are exerted.

This book should be included in the library of all who are interested in the design, construction and operation of turbines as a sequel and completion of Stodola's monumental work on the steam turbine. The proceeds from the book go to Dr. Stodola as a birthday present.

Book Notes

RESEARCH NARRATIVES. Vol. 3. Narratives Nos. 101 to 150. New York: Engineering Foundation. Price, $1.

This little book of 50 brief stories of research, invention, discovery and engineering, contributed by the "men who did it," is the third in a series. It is illustrated with a few portraits. Some of the titles are: "Distances of the Stars," "Contour Mapping from the Air," "Pictures by Phone," "Boiling and Roasting Ores," "The Gyro's Strange Intuitions," "New Light from the Nebulæ on the Nature of Matter," "Wealth from Cornstalks," "Ice—Relief from Its Damage," "Chromium," and "Amateur 'Movies' in Color." John J. Carty has written a brief introduction to the volume under the heading "Peace and Plenty Through Science," in which he says: "According to the vision of science, life must no longer be regarded as a struggle among men for a limited store where one man's gain or one nation's gain must be another's loss. Under the banner of scientific research we are asked to join with our fellow-men, working together in controlling and utilizing the boundless forces of nature. Such is the message of Research Narratives."

RADIO OPERATING QUESTIONS AND ANSWERS. By A. R. Nilson and J. L. Hornung. New York: McGraw-Hill Book Company, Inc. Second edition, revised, 267 pages. Price, $3.

This is a very practical book on radio and the treatment lends itself to clarity and directness. Questions are asked and answers given covering all aspects of theory, apparatus and operation in the radio field. The book is sectionalized into chapters and illustrations are used freely.

News of the Industry

Maine Power Bill Lost

Decisive Majority Cast Against Measure to Permit Exportation of Surplus Electricity — Wyman Pledges All Possible Help to Industrial Growth, Notwithstanding

RETURNS from the vote taken in Maine on Monday, September 9, upon the Smith-Carleton referendum measure to permit the exportation of surplus hydro-electricity beyond the state's boundaries show a decisive defeat for the proposal. The total vote from 582 out of 632 precincts was: For the bill, 54,047; against the bill, 61,999. This indicates a total majority against it of more than 8,000. Antagonism in the rural districts was very strong, and though the bill did better in most of the cities, where the vote was close, it was reported beaten in Bangor by 2,000 votes and in Auburn by two to one.

Walter S. Wyman, president of the Central Maine Power Company, issued the following statement as soon as the result was known:

"It is apparent that the Smith-Carleton export bill has failed to pass. I am exceedingly sorry for this, as I sincerely believe it would have been a great help to the State of Maine. However, we will go ahead and do our level best in every way that is possible to improve the industrial conditions in the state. We have done this in the past and pledge ourselves to do it in the future."

New York Officials Criticise Public Utilities

Speaking at a conference of municipal counselors held at Albany, N. Y., this week to discuss the advisability of proposing changes in the Public Service Commission law to the temporary commission appointed by the last Legislature to investigate the present laws and practices, Arthur J. W. Hilly, Corporation Counsel for New York City, said: "If we do not get co-operation from the existing gas and electric companies and from the commission, will it not follow that we must take the problem of gas and electric supply into our own hands?"

Mr. Hilly declared himself personally opposed to municipal ownership of utilities. Alleged failure of New York City to get all the facts necessary for it to "form a reasonable opinion on which a just rate order could be based" in recent contests with the gas companies was his immediate inspiration.

"The Public Service Commission is not only an asset of the public utilities but a detriment to the cities of the state," Mayor Cornelius F. Burns of Troy declared at this meeting. He said that ever since the Public Service Commission was organized the cities have been virtually at the mercy of the public utilities and that there is not a chance for any municipality to escape today, except possibly New York, Buffalo or some other city large enough to hire utility experts to protect its interests.

The conference voted to appoint a committee of seven to confer with the commission investigating the law. This committee will be appointed by Frederick C. McLaughlin of White Plains, president of the New York State Mayors' Conference, and will consist of city or village corporation counsels.

Pennsylvania Men Stimulated to Sell

Leaders of the Industry Urge Enlargement of Market for Energy, Wiring and Appliances—More than Nine Hundred Delegates Profit from Bedford Springs Convention

ADMONITION to sell more wiring, more appliances and thus more kilowatt-hours during the coming months might be accepted as the composite message of prominent speakers at the twenty-second annual convention of the Pennsylvania Electric Association, held at Bedford Springs, Pa., on September 4, 5 and 6. Notable among those urging such activity as the most promising and pressing of current opportunities for utility organizations were Matthew S. Sloan, president of the National Electric Light Association; Frank R. Phillips, president of the Pennsylvania Electric Association and senior vice-president of the Philadelphia Company; A. B. Millar, managing director of the Pennsylvania Electric Association, and E. W. Judy, vice-president and general manager of the Duquesne Light Company.

"We have accomplished great things technically," said Mr. Sloan. "We have done great things in making ever-improving service available to more and more people for more and more forms of use. But we still have a long way to go, both in reaching others who could profit by the use of electric service and in effecting a wider use of service by those now on our companies' lines. The test of our industry now, as in the past, is its usefulness to the public. The path of progress for us is clearly outlined. It is to supply better service, to reach more customers with it, to sell it at lower rates and to make it more useful to all our customers."

A reception to President and Mrs. Phillips on Wednesday evening was the only official activity that day. The first general session on Thursday was given over to the presidential address, the reports of various committees and an address by A. B. Millar, managing director of the association. President Phillips particularly emphasized the rapid growth of rural electrification in Pennsylvania, showing that while between 5 and 6 per cent of the nation's farmers received the benefits of electric service, in Pennsylvania 32.5 per cent were served. Present construction work is proceeding in that state at a rate of 4.7 miles per day, an estimated daily gain of 54 rural customers.

Following a review of the year's work, C. H. Frick, Pennsylvania Power & Light Company, chairman, at the engineering session Thursday afternoon, introduced E. C. Stone of the Duquesne Light Company, who emphasized the benefits to be derived from the committee work of electrical associations and who contended that engineering policies should be formulated with public and commission viewpoints in mind in order to promote harmonious relationships.

C. S. Coler of the Westinghouse Electric & Manufacturing Company discussed the recruiting and training of engineers for the power industry, pointing out that the supply of well-qualified men has always been limited and that the full co-operation of manufacturers and utilities is to be encouraged.

In enumerating the various activities to which safety department work is related Edward C. Spring, director National Safety Council, gave relative preference to operating, construction, employment, purchase of supplies, welfare of employees and public relations. "Every employee should be in complete accord with what safety means to him and his fellow workers or be removed," said Mr. Spring.

A demonstration of the transformation of light energy to sound energy and of the transmission of sound by projected light paths was made by John B. Taylor of the research laboratory of the General Electric Company.

As chairman of the accounting session H. P. Smith of the Duquesne Light Company suggested that the accountant was becoming more and more important in utility work, if for no other reason because of his relation in establishing fundamental facts for action in the increasingly important transition between existing and proposed rate forms.

E. A. Davis, general auditor Middle West Utilities Company, paid high tribute to the results for improved economy realized through the uniform classification of accounts.

"What About Public Relations?" was the title of the address by Harry Reid, president of the National Electric Power Company and chairman of the Public Relations National Section of the N.E.L.A. "It has always been my belief," Mr. Reid said, "that good service is the best answer to the demagogue. Here are the two goals of public relations work—to understand and to be understood, to know and to be known, and to be guided and helped by this mutual process."

Henry Swift Ives of the Association of Casualty and Surety Executives spoke on "The Duty of Industry to the Public," and R. N. Blasingame, chairman of the farm machinery division at Pennsylvania State College, reviewed progress in the use of electricity on the farm and its potentialities.

The final session, that of the Commercial Section, was addressed by H. C. Thuerk of the Erie Lighting Company, chairman; A. W. Robertson, chairman of the board of the Westinghouse Electric & Manufacturing Company; Paul Freedley of the Pennsylvania Salt Manufacturing Company, and A. S. Turner of the Edison Lamp Works. Mr. Robertson reminded the audience that the point of view of the customer is non-technical. Mr. Freedley emphasized the influence of obsolescence of generating equipment in private plants and central stations upon the decision of the industrial customers to purchase power and urged the continued and more intensive study of "border-line" conditions to determine the economics of any given problem. According to Mr. Turner, America pays $45,000,000 a year for light that it never receives owing to drops in voltage on the customers' premises occasioned by inadequate equipment.

The program included a number of special entertainment features, a session for women, talking "movies" at each session presenting prominent men and their messages, and a first-aid contest.

More than 915 delegates and guests registered. Officers for the coming year are: President, John F. Ford, Philadelphia Electric Company; vice-presidents. F. B. Hofft of Johnstown and W. H. Horton, Jr., of Pittsburgh.

Governor Kohler Signs Bill for Utility Taxation

Governor Kohler of Wisconsin has signed the Reis bill which requires that public utilities other than railroads and sleeping-car companies shall be subject to the income tax, and that property taxes of gas, water, electric and steam utilities extending into two or more assessment districts shall be taxed at the state rate instead of at the local rate, as at present. The State Tax Commission has just announced that light and power companies not operating also street railways will be assessed at $59,608,700, as compared with $54,260,800 a year ago.

Assemblyman Reis got through the House a measure to make all utilities pay at the local rate, which is generally higher than the state rate. His bill as amended by the Senate and agreed to by the companies is expected to raise about $1,000,000 additional revenue annually. It is the only one of the big utility bills to pass the Senate.

Northwest Inspectors Find Many Live Topics

Grounding, Armored Cable and the Desirability or Otherwise of Cheaper Wiring Especially Interesting to Men at Vancouver (B. C.) Convention

WITH 150 delegates, including many men of national prominence in the inspection field, in attendance, the fourth annual convention of the Northwest Section of the International Association of Electrical Inspectors was held at Vancouver, British Columbia, on September 9 to 11. Inspirational addresses by J. C. Forsyth, New York, president of the parent body, and W. S. Boyd, Chicago, secretary of its Western Section, brought the responsibility of the inspector and the opportunities before him forcibly before the delegates.

The subjects of grounding, armored cables and "Is Cheaper Wiring Necessary or Desirable?" provoked the most discussion. The report of the code clearing-house committee containing recommendations on wattage requirements for different occupancies and different-sized rooms with a view to providing in the code for a minimum standard of adequacy was hailed as the most constructive piece of code criticism yet to be produced by a geographic section of the association.

Among the addresses made were one by the president of the section, Harry A. Patton, Washington Surveying and Rating Bureau, Seattle, who pleaded for universal adoption of the national code, and one by Major H. S. Bennion, director of engineering, N.E.L.A., favoring cheaper wiring, on which some adverse criticism was passed. A digest of this paper will appear next week.

Another controversy was dealt with in a paper by Dr. M. G. Lloyd, director of the Bureau of Standards, in which the many phases of grounding were fully discussed. A written commentary on the paper by S. B. Clark, Northwestern Electric Company, Portland, evoked a discussion on the desirability of multiple grounds within buildings.

Dana Pierce, president Underwriters' Laboratories, Chicago; Victor H. Tousley, electrical field engineer National Fire Protection Association, Chicago; Harry Kirkland of the Society for Electrical Development and A. Penn Denton of the National Electrical Manufacturers' Association, in a paper read by W. J. Canada, made valuable contributions to the program, the last named eliciting a discussion on the shortcomings of the old type of cable.

C. S. Fletcher, Vancouver, B. C., was elected president and C. B. Gleason, Tacoma, Wash., vice-president.

Rocky Mountain Men at Glenwood Springs

N.E.L.A. Division and Colorado and Wyoming Utilities Associations Mingle Business and Pleasure at Annual Gathering and Listen to Leaders

SPORT, entertainment and business divided the attention of the delegations to the joint convention of the Rocky Mountain Division of the N.E.L.A., the Colorado Utilities Association and the Wyoming Utilities Association held at Glenwood Springs, Colo., on September 2, 3 and 4. The first day was devoted entirely to pleasure. On Tuesday and Wednesday the delegates got down to business, W. D. Johnston, president of the N.E.L.A. division, and V. L. Board, president Colorado Utilities Association, presiding jointly.

Following Mr. Johnston's official address were speeches by Managing Director P. S. Clapp and other representatives of the national body. The jubilee theme pervaded all the proceedings. Mr. Clapp reviewed the progress of the industry and declared that it is on the threshold of development so momentous that even its leaders can hardly grasp their significance.

C. E. Greenwood, commercial director N.E.L.A., described the national food preservation program and its relation to the electrical industry. Talking motion pictures of Edison and other notable men with messages to deliver to utility builders were presented, a review of the Atlantic City N.E.L.A. convention was given, and an informative meeting for women was held in which wives of the delegates took part.

Other addresses were made by Mr. Board, B. J. Mullaney of Chicago, F. S. Peterson of the Public Service Company of Colorado, who spoke on the utilities' interest in airport development; Howard S. Robertson, who spoke on the changing aspects of mass transportation, and R. W. Lindsay, telephone engineer.

A picnic was held on Tuesday evening, and the annual banquet concluded the program Wednesday night. J. A. Clay, Western Colorado Power Company, was elected president of the Rocky Mountain Division, N.E.L.A.; Ray M. Morris, Mountain States Telephone Company, of the Colorado Utilities Association, and H. L. Williams, Evanston, Wyo., of the Wyoming Utilities Association.

Federal Trade Commission's Utility Investigation

Although no plans of action have been announced by the Federal Trade Commission, which reconvened on Monday of this week after the summer recess, it is expected that hearings in the public

utilities investigation will be resumed at an early date.

Senator Norris has launched a move to have the commission send detailed reports of its hearings to the Senate, including extracts from the more important exhibits made part of the record there. Mr. Norris wants the Senate to have also figures on the capital assets and liabilities of interstate power companies, their security issues and the charges made for service by holding companies. These are to be brought out in the financial phase of the inquiry.

Sharing Prosperity With the Public

With This End in View New Englanders Discuss Industry Policies—Mass Production, Promotional Rates and Vigorous Commercial Activity Serve Best

STIRRING addresses upon the splendid service rendered by the power industry to American civilization and forward-looking counsel as to ways and means of further development, leading to prosperity which the public will share, characterized the twenty-first annual convention of the New England Division of the National Electric Light Association this week at New London, Conn.

After Lieutenant-Governor Rogers of Connecticut had welcomed the visitors, President M. S. Sloan of the national body spoke at the opening session Monday evening upon the economic contributions and opportunities of the industry to the public welfare, stressing the effect of electric service upon mass production, high wages and purchasing power, pointing out the importance of promotional rates and alluding to the need of long-time programs for complete home electrification instead of flash-in-the pan campaigns. Charles A. Eaton, member of Congress from New Jersey, voiced the ideals of the industry's service which have strengthened its position as a major factor in the growth of civilization and urged stalwart defense of proven policies in the face of political attacks. Richard T. Higgins, chairman of the Connecticut Public Utilities Commission; John L. Madden, vice-president of the Metropolitan Life Insurance Company; Managing Director Paul S. Clapp, Anna Steese Richardson, Dudley Harmon, executive vice-president New England Council, and Katherine A. Fisher also contributed timely addresses.

President I. W. Day's address stressed the need of greater effort to increase the per capita use of electric service in New England, which has 10 per cent of the central-station customers of the country with only 6.5 per cent of the electricity generated. He also advocated a simplification of the committee work of the association.

Chief interest perhaps centered in the Commercial Section. In opening its sessions on Tuesday President Day admitted that inducement rates, appliance sales, window-dressing and other things are essential factors in increasing the sale of electric service, but held them to be useless unless backed up with real sales effort.

D. M. De Bard, chairman of the Merchandising Bureau, dwelt chiefly on the great opportunities left for merchandising, pointing out that 33 per cent can be added to domestic lighting, 70 per cent to home appliances, and about 98 per cent to ranges and water heaters. On conservative estimates the average domestic revenue can be raised to $100 a year. He declared, however, that inducement rates are a prerequisite to increased sales.

Sarah Harding Hunter cited several conditions that are preventing wider acceptance of household conveniences, mentioning the pride with which some thrifty housewives hold down the use of energy. Furthermore, she took utility people to task for not practicing what they preach, quoting from the testimony of 150 executives and the same number of employees to show their own limited use of appliances.

W. G. Keay sketched efforts being made to arouse a greater appreciation of the importance of low temperature in preserving food and health.

The principal speaker before the Power Bureau group—John L. Madden—reviewed the findings of the Metropolitan Life Insurance Company on "migration of industry," originally presented at Atlantic City, and went into some details affecting New England. The most significant conclusions which he drew from the national figures are: (1) that the net value of attempting to attract industries into new territories is very small and hardly justified by the expense; (2) little money is spent to help new industries develop once they are obtained; (3) adequate data are not kept on the rate of expansion of existing industries, and (4) little attempt is made to ascertain why industries move away. To serve as a barometer of business, Mr. Madden said, the survey should be made perpetual by some neutral organization like the United States Department of Commerce.

The principal points made by A. W. Milliken, chairman of the Power Bureau, were that utilities should be guided in their sales work by what is best in the long run for their customers and that an opportunity to formulate rates should be given to power salesmen.

The Accounting Section held two large and enthusiastic sessions on Monday, at which much informal discussion took place on merchandising accounting and other moot topics. A women's session on Wednesday morning, one on public relations on the evening of the same day and an engineering session on Thursday morning all proved worth while.

Purchases and Mergers

Pierre, S. D., Refuses to Sell Municipality's Plant, but Communities in Georgia, North Carolina, Missouri and Saskatchewan Decide Otherwise

PIERRE (S. D.) voters at a special election on September 4 decided more than two to one against the sale of the municipal lighting plant to the Northwestern Public Service Company. Unofficial figures gave a count of 1,039 against the sale and 492 for it. The company had made an offer of $325,000 for the plant.

The City Council of Cedartown, Ga., has sold to the Georgia Power Company the municipal electric light plant and franchise for $575,000, with $75,000 in cash and the balance in installments. The sum more than covers the bonded indebtedness of the city.

The town of Ellenboro, N. C., has voted to sell its municipal light and power plant to the Southern Public Utilities Company for $18,500. No votes were cast against the sale.

The Missouri Power & Light Company has acquired the municipal electric light plant at LaGrange, the voters sanctioning the sale by 341 to 36.

The Winsted (Conn.) Gas Company, which also sells electrical energy, was acquired recently by the Connecticut Electric Service Company at Hartford and has now offered a new schedule of electric rates.

Petition is made by the New York Power & Light Corporation for leave to acquire and merge the Schodack Light & Power Corporation of Castleton, N. Y., which has hitherto purchased energy from the New York company for resale.

With the approval of the New York Public Service Commission, the Montgomery Electric Light & Power Company was recently merged with the New York Power & Light Corporation as of August 1. The territory added includes Canajoharie, Sharon Springs, Cherry Valley and the intervening sections.

Approval of the merger of the Philadelphia Suburban Counties Gas & Electric Company, the Delaware County Electric Company and three gas companies with the Philadelphia Electric Company was asked last week in two applications filed with the Pennsylvania Public Service Commission. These utilities serve Philadelphia, Bucks, Montgomery, Delaware and Chester Counties.

The Pennsylvania Power & Light Company told the commission it would make a 10 per cent reduction in residential rates for Souderton, Montgomery County, if the company is permitted to purchase for $153,000 the electric light plant owned by Souderton, for which a contract of purchase was made last year. The commission also received applications from the Northern Pennsylvania Power Company for purchase of electric companies incorporated to serve Tioga-Clymer, Tioga-Rutland, Tioga-Roseville, Lycoming-Jackson, Lycoming-Cascade and Lycoming-Gamble. These companies never became operative.

Application has been made to the Maryland Public Service Commission by the Woodbine Light & Power Company, the Potomac Edison Company and the Consolidated Gas, Electric Light & Power Company of Baltimore for the sale of the first-named company, organized by farmers in 1925, to the other two for $10,700.

The town of Melfort, Saskatchewan,

has decided to sell its municipal electric plant to Canadian Utilities, Ltd., with a 20-year franchise, for $100,000. The company proposes to spend nearly $500,000 to enlarge the plant so that power may be transmitted to the neighboring towns and district. Rosetown, Sask., will sell its plant to the same company, and the electric utility of the town of Humboldt, Sask., will go to the Dominion Electric Power Company for $70,000, with a 20-year franchise, subject to ratification by the property holders.

"Light's Golden Jubilee" Plans Are Widespread

Two Hundred and Ninety Million Postage Stamps—Italy Will Demonstrate—Oklahoma's Governor Takes a Hand—Texas State Fair—Celebrations at Dayton, Denver and Buffalo

AN ADDITIONAL issue of 110,000,000 special two-cent Edison commemorative postage stamps has been announced by the Postmaster General. The first edition of this stamp has nearly been exhausted. Combining the second with the first issue of 180,000,000, the total will be 290,000,000 stamps, having a value of $5,800,000.

Giuseppe Belluzza, Minister of Public Instruction, and Alessandro Martelli, Minister of National Economy, jointly head the sponsoring committee for "Light's Golden Jubilee" celebrations in Italy, and Guglielmo Marconi is on the list of honorary members. The committee plans an elaborate demonstration on October 21, simultaneously with the festivities at Dearborn, Mich. Italy is one of a number of European nations which will participate in the commemoration. Others already heard from in a preliminary way are France, Austria, Germany, Holland and Sweden. Japan has a program partly formulated. Buenos Aires will have a light festival.

Floodlighting on an extensive scale in Quebec will include Montmorency Falls and the Parliament Buildings, and the Mayor of Montreal will head a workers' committee in that city.

The Governor of Oklahoma has issued a proclamation asking that October 21 be observed with "festivities and exercises" and a general celebration from 6 to 10 p.m. This proclamation has been engraved for public distribution.

A similar proclamation has been issued by the Governor of Texas. The 1929 state fair in this commonwealth is to be known as "Light's Golden Jubilee Fair" by order of the directors. The electrical interests will carry out at the fair a program of special illumination which will transform the main plaza into a scene of brilliance, with an arch of jewels and all the resources of floodlighting and spectacular devices brought into play. This celebration will culminate in a gala Edison Day program on October 21.

Electric light standards in Main Street, Dayton, Ohio, will during the week of October 14-21 be painted bright gold in observance of "Light's Golden Jubilee." Bulbs of 1,000 watts will light the street at night and 500 replicas of Mr. Edison's first light will be placed in downtown stores. Special lighting will be arranged for Dayton's historical points, including the "Log Cabin," Patterson memorial, old court house, soldiers' monument and McKinley monument. The Edison observance is being planned by a group of business and professional men headed by Orville Wright, honorary chairman, and O. B. Reemelin of the Dayton Power & Light Company, general chairman. William Hartman, president of the Engineers' Club, is arranging a dinner to be held during observance week.

At Denver, Colo., a "Days of '79" dance is being arranged at the Union Station. Old-style lanterns, coal-oil lamps and gas-jet illumination will be utilized. The aviation committee is completing plans for a night air circus featuring broadcasting from the air and

Headquarters of Buffalo's Jubilee Committee

lighted airships. Special activities in the schools have been sanctioned, culminating in an educational exhibit.

Buffalo, N. Y., has set up headquarters for its local committee in the Market Arcade, Main Street. Buffalo will celebrate on October 10 to 12.

Water Shortage in Oregon

Another record-breaking water shortage is occurring in Oregon, according to reports being received by the Public Service Commission and the state engineer. For the past five years, data in these two departments disclose, the water supply in that state for power and domestic purposes has continued to diminish until up to the present writing conditions have become alarming in various sections of the state. Changing climatic conditions, together with a vastly increased demand for water for irrigation and mining, are among the causes said to be contributing to the shortage.

Drought Puts Big Load on New England Tie Lines

Prolonged drought recently brought a condition of extreme low water in the Connecticut River, which was reduced to a flow of 2,300 sec.-ft. on September 4 at Turners Falls as against a normal flow of 6,000 sec.-ft. The Turners Falls Power & Electric Company was obliged in consequence to draw on the steam plants of the United Electric Light Company of Springfield and the Hartford Electric Light Company for electricity with which to meet the requirements of its customers in western Massachusetts, thus demonstrating once more the advantages of the interconnections some years ago.

How Steam Plants Came to Rescue in New York

Company Official Describes Maintenance of Complete Service on Mohawk-Hudson System Despite Long Drought and Hard-Hit Hydro Plants

FURTHER details of the way in which the large steam-electric generating plants of the Mohawk-Hudson Power Corporation supplemented the production of electricity by water power in the extraordinary conditions of drought that prevailed during August (ELECTRICAL WORLD for September 7, page 485) have been furnished by Otto Snyder, executive vice-president of the New York Power & Light Corporation. Mr. Snyder says that in August the hydro-electric stations supplying the system generated about 33,000,000 kw.-hr. less than in August, 1928, when the water supply was more nearly normal.

As illustrating the care taken to conserve water for power generation during the drought, Mr. Snyder said that many of the generators in the hydro-electric stations are being closed down during the noon hour, when the industrial load falls off. When the demand from industries drops late in the afternoon the generators at the water-power plants are again shut down to permit the storage ponds to fill up as much as possible during the night. The Amsterdam steam station of the New York Power & Light Corporation, of 75,000 kva. rating, together with the Riverside steam plant at Albany and the Harbor Point plant of the Utica Gas & Electric Company, are now supplying 150,000 hp. almost continuously to meet the most serious shortage of water experienced since 1923.

Mr. Snyder cites the case of the Spier Falls and Cohoes hydro-electric plants of the New York Power & Light Corporation as examples of how the production of power from water was reduced during the drought. The Spier Falls plant, on the Hudson River, generated 6,100,000 kw.-hr. during August as against 10,400,000 kw.-hr. in April. At the Cohoes plant, on the Mohawk River, only 5,000,000 kw.-hr. was generated during August as contrasted with 14,300,000 kw.-hr. in April.

Storage reservoirs of the company in the Hudson River watershed have been reduced in the aggregate to 37 per cent of their capacity and those in the Mohawk River watershed to 60 per cent of their capacity.

Diverse Papers at Coast Institute Meeting

Effect of Surges on Transformer Windings, Alternating-Current Networks, System Stability and Other Themes Arouse Lively Discussions at Santa Monica

A NUMBER of excellent technical papers presented at three general sessions and two student meetings, and which aroused animated discussion, concluded the successful convention of the eight Pacific Coast sections of the American Institute of Electrical Engineers, held at Santa Monica, Calif., from Tuesday to Friday of last week and reported in part in the ELECTRICAL WORLD for September 7 (page 484).

A résumé of research work extending over a period of 35 years contained in a paper by C. E. Skinner showed that intensive development work by electrical manufacturers and the oil companies has produced electrical insulating oils which are among the most satisfactory devices now used by the electrical industry.

The effect of tank color on transformer temperature as indicated by a number of field tests is so little that V. M. Montsinger and L. Wetherill, the authors of a paper on this subject, concluded that durability and appearance are the factors that should govern the paint used. Two degrees Centigrade was the average gain in temperature resulting from the use of white as against black paint, and discussion brought out the fact that the difficulty of keeping outdoor transformer tanks clean further reduces the small benefits from the use of white or metallic paint.

By the use of a curve of the "logistic" type, as developed by Raymond Pearl, N. B. Hinson showed that fairly accurate estimates of increase in population of a given territory may be made as an aid in planning electrical development.

A valuable contribution on the origin of flames from arcs was made by Dr. J. Slepian. His paper gave computations and described experiments showing how flames may be reduced by extinguishing the arc by means of a column of deïonizing metal plates as is done in the "deïon" breaker.

A large number of multiple air paths to increase ventilation in long machines, two-winding generators, higher terminal voltages and hydrogen cooling were given as some of the features that may be incorporated to make possible larger turbo-generators by W. J. Foster and M. A. Savage, who saw no reason why a generator could not be designed and built for a rating of 200,000 kw. at 90 per cent power factor.

A paper on the effect of surges on transformer windings by J. K. Hodnette evoked considerable discussion of a highly technical nature. Cathode-ray oscillograph test data presented showed that the greatest stresses are on the line group of coils of a transformer and are produced by surges of very steep wave fronts and that the initial distribution of voltage is the only factor necessary to consider. F. W. Peek discussed the nature of lightning and explained how shields on the end of transformer windings cancel out the capacity to ground and reduce stresses about one hundred to one under service conditions. This had reference to the non-resonating transformer as developed by his company.

The alternating-current low-voltage network in Spokane using the loop feeder system was described in a paper by L. R. Gamble. No difficulties have been experienced with the system, and in the Spokane case certain savings were made over use of the radial system with network protectors. Discussion however, showed that forty cities have adopted the radial system with network protectors as against only two using the loop system.

R. Wilkins in a paper on high-voltage, low-current fuses and switches concluded that for service where overload protection only is desired and moderate interrupting capacity is sufficient the present-day fuses are reasonably satisfactory.

Two papers dealing with system stability concluded the program. The first of these, by I. H. Summers and J. B. McClure, dealt with progress in its study. The authors felt that the development of high-speed relaying and oil-circuit-breaker operation is the best all-round solution to the stability problem. In discussion it was pointed out that in speeding up oil-circuit-breaker operation one may simply go from one type of trouble to another. However, there was general agreement that oil circuit breakers which will open fault currents in one-half second or less are the greatest need. It was also pointed out that high-speed excitation may defeat its purpose in many cases and that increased energy fed into the system and the greater shock may offset its value. J. P. Jollyman stated that the question of system stability will be largely solved if trouble is cleared quickly and that the time must be no greater than one-half second and as much less as is physically possible.

A totally different attack on the stability problem was presented in a paper by T. H. Morgan. He offered as a field for careful study the proposal to supply the voltage consumed by line reactance by the use of series capacity in the line. This might take the form of a synchronous condenser connected to the line through the equivalent of current transformers and driven so that its voltage relation would have the proper relation to that of the line. This scheme would not, however, make possible dispensing with synchronous condensers as now used, since these would still be required for power-factor correction.

A paper on electrical control for wind tunnels, one on electrical engineering of sound pictures, another on the dial telephone system and a fourth on a mathematical solution of parallel transformer operation were also included in the program of the final day.

Many inspection trips to points of interest, ample time for sports, a banquet and one evening meeting all contributed to the success of the convention. Decision was reached to request the Institute directors to set Portland, Ore., as the meeting place for the 1930 convention.

Many Activities of Accident Prevention Committee

Widespread activity on the part of the accident prevention committee of the Engineering Section, National Electric Light Association, of which committee C. R. Beardsley is chairman, is indicated by an official synopsis of the studies now being made by the 24 subcommittees. With one exception—that of the subcommittee on grounding—a specific assignment of work in the nature either of new research or of completion of work previously begun has been made to every subcommittee, the general nature of which is indicated by the name of the committee. Subcommittee 12, on geographic divisions, is to stimulate and co-ordinate activities in these divisions and finish a manual for the use of the chairmen of their accident prevention committees. The subcommittees are:

1. Accident Cause Analyses.
2. Automobile Accidents.
3. Cable Identification.
4. Codes.
5. Construction.
6. Co-operation with National Safety Council.
7. Cost of Accidents.
8. Editing and Publicity.
9. Educational Institutions.
10. Fire Prevention.
11. First Aid.
12. Geographic Divisions.
13. Grounding.
14. Handbook Safety Training.
15. High-Voltage Tests.
16. Hot-Line Tools.
17. Interlocks.
18. Low-Voltage Hazards.
19. Resuscitation and Insull Medal Award.
20. Rubber Gloves and Goods.
21. Safety Provisions, Devices and Appliances.
22. Statistics.
23. Tree Pruning.
24. Unusual Accidents.

Iowa Municipal Officers Want Utility Information

Iowa's lack of a public utility commission and the alleged inability of municipalities to obtain necessary information upon which to exercise their power of establishing power rates were dwelt upon in a discussion of utility topics at a recent annual convention of the Iowa League of Municipalities in Fort Dodge. Frank Pierce, Marshalltown, secretary, asserted that municipally operated plants at Muscatine, Ames and Cedar Falls established the claim that "electricity can be supplied to the consumer for a considerably less amount than is being charged by most of the private utilities." "Municipalities have the power to fix rates," he continued,

"but do not have any power to secure, except at prohibitive cost, the necessary information on which to fix them. If we could secure a law providing that when a municipality desires to fix rates it would have the right to apply to the courts to give the information necessary, with the right of the municipality to question the witnesses, the necessary information could be obtained."

W. G. Ray, Mayor of Grinnell and president of the league, said that city councils should have an experienced auditing board to study rates in order to protect the public against exorbitant charges. J. Van Der Zee, Iowa City, urged a state law requiring that every public utility company be required to make annually a detailed report to city councils of its assets, liabilities and profits.

Great Lakes Division Ready for French Lick

"Movietones" introducing Edison, Sir Ernest Benn and others, music and entertainment indoors and outdoors have been provided in abundance to enliven the convention of the Great Lakes Division, N.E.L.A., which will be held at French Lick Springs, Ind., on September 26, 27 and 28. The chairmen of three of the national sections are expected to be present. Addresses, papers and reports will fill the morning sessions as follows:

Thursday, September 26.—President's address, G. C. Neff; report of secretary-treasurer, Tom C. Polk; address, Harry Reid, chairman Public Relations National Section; address, Managing Director Clapp; "Some Problems of Present-Day Public Utility Regulation," W. J. Hagenah; "Lighting or Lamps?" J. W. McIver, Edison Lamp Works, Harrison, N. J.; "Research—Its Value and Its Necessity with Reference to the Electric Supply Industry," C. F. Hirschfeld, Detroit Edison Company.

Friday, September 27.—"Sources of Information in the Electric Light and Power Field," E. J. Fowler, Commonwealth Edison Company; address, Marshall E. Sampsell, chairman Commercial National Section; "Development of Electricity on the Farm," M. S. Winder, secretary American Farm Bureau Federation; "Sales Development," E. L. Hinchcliff, Middle West Utilities Company; "Blue-Sky Regulation and Public Utility Securities," George C. Mathews, Wisconsin Railroad Commission; address, Eloise Davidson, N.E.L.A. headquarters; "Architect's Contact," Robert J. Malcomson, Public Service Company of Northern Illinois.

Saturday, September 28.—"Rates for Electric Service," Frank E. Kruesi, Middle West Utilities Company; "Selling the Lighting Service Department to Company Executives," J. F. Blackburn, Rockford Electric Company; "Broader Aspects of Engineering," L. B. Andrus, president Central Indiana Power Company; "The New Competition in Power Sales," C. D. Malloch, Consumers Power Company; address, A. D. Bailey, chairman Engineering National Section; "Industrial Development and the Public Utilities," A. R. Gwinn, Central Illinois Public Service Company.

Power system stability as affected by design of hydraulic plants, of steam plants, of electrical apparatus and of transmission lines and by general system characteristics is billed as the topic for the open session of the Great Lakes Engineering Section, N.E.L.A., at its fall meeting in Madison, Wis., October 23 to 26. The tentative program lists an imposing array of national authorities who will discuss the various phases of the subject. This open meeting will be sponsored by the electrical apparatus, hydraulic power and prime movers committees, and if the present plans carry through, the topic will be very thorougly analyzed.

Attack on Public Utilities by Indiana Contractors

New Law Governing Ornamental Street Lighting Declared "Bold and Arrogant" Measure "Put Over" on the Lawmakers in Utility Interest

FIGHT has been declared by some large electrical contractors in Indiana against a law passed at the last session of the Legislature and affecting ornamental lighting on city streets. Starting at Hammond, Ind., the protests may become state-wide. In Hammond A. E. Oltz of the General Engineering & Sales Company declared that the law "probably is the most bold and arrogant piece of public utility legislation ever put over on any legislature." He made this assertion in a letter to A. B. Walton, manager of the Association of Certified Electricians at Washington, D. C.

It is the contention of the protesting contractors that the statute virtually eliminates them from the construction of ornamental street-lighting projects and gives all this over to the public utilities themselves. The measure provides that where "extra illumination" is desired the board of public works or city council shall negotiate "with any public electric utility then operating and supplying electrical current within such city and shall endeavor to enter into a contract with any such utility for furnishing the lighting described in said plans and specifications, and said board of works may cause such city to enter into such contract with such utility for such lighting." The contract shall require lighting service for not less than five years and not more than fifteen years. In event that the city and the utility cannot agree on a price, the matter is left to the jurisdiction of the Indiana Public Service Commission, which will fix a price binding on both.

The statute further says: "After a contract has been entered into between the city and utility and approved by the Public Service Commission of Indiana, the utility which is the party to such contract or order shall forthwith within a reasonable time construct at its cost such improvement and thereafter maintain and operate the same in strict accordance with such agreement and order and at such annual rates as are fixed by the contract." Here seems to be where private contractors are left entirely out.

The statute permits 60 per cent of the property owners in any city block to file with the board of public works a petition for "extra illumination." In Indianapolis the first petitions under the new law were filed in July requesting ornamental lighting on thirteen west side streets. No action has been taken, City Engineer Moore saying that it would be impossible to do any work under the new law with the present engineering staff before the winter. The board may decide to make no installations under the new law, on the ground that the plan would be unfair to persons already living on streets with ornamental lighting.

Usual Full Program Arranged for A.E.R.A. Convention

A program covering, as usual, every phase of electric railway operation has been arranged for the forty-eighth annual convention of the American Electric Railway Association, to be held at the new Municipal Auditorium in Atlantic City, N. J., from September 30 to October 4 inclusive. Informal round-table luncheon conferences will, as in previous years, be a feature of the meeting. Among speakers well known in general utility-company circles are W. E. Wood, president Virginia Electric & Power Company; Lucius S. Storrs, whose topic will be "Public Relations," and Thomas N. McCarter, president Public Service Electric & Gas Company, Newark, N. J.

"The Business Week" Makes Its Appearance

Latest among McGraw-Hill publications is *The Business Week*, the first number of which, under date of September 7, has made its appearance on news stands and in the mails. This paper is an outgrowth of the *Magazine of Business*, which came out for the last time in August. Concerning the new magazine Malcolm Muir, president of the McGraw-Hill Publishing Company, said this week:

"We build *The Business Week* upon a foundation of 22 specialized journals in the McGraw-Hill organization. Each contributes its highly developed news sources, its expert specialized knowledge, to the new publication. Crossing the vertical organization of the McGraw-Hill journals is the staff of *The Business Week*, which divides business horizontally, by functions."

Marc A. Rose is managing editor of the new publication. Other members of its staff are Gorton James, editor for marketing and distribution; Virgil Jordan, economist; Elbert Baldwin, European news director with office in Paris; K. W. Stillman, industrial production; D. B. Woodward, finance and banking; Marvin M. Black, transportation and utilities, and John H. Millar, Chicago representative.

Transmission Line Supplement with Next Issue

Unexpected delays due to mechanical difficulties arising from the unusual size of the tabulation of "Engineering Details of Transmission Lines in the United States" have necessitated postponing the issuance of the supplement which was scheduled to accompany this number of the ELECTRICAL WORLD. It will be published next week.

Briefer News

EASTERN JERSEY LIGHT RATES CUT.—The Eastern New Jersey Light & Power Company announce a reduction on domestic and commercial light rates in 31 municipalities in Monmouth, Ocean, Burlington, Mercer and Middlesex Counties. One hundred kilowatt-hours under the new schedule will cost $9.75, while under the old schedule the cost was $12.

PLAN NEW STEAM-ELECTRIC PLANT FOR MOSCOW.—Owing to the great increase in demand for power supply in the Moscow district, plans are being prepared for a new 300,000-kw. generating station to be erected at Bobriki, near Moscow. It is intended to install four 75,000-kw. turbo-generators to work at a pressure of 35 atmospheres and at a temperature of 425 deg. C. The boilers will be fired by pulverized fuel.

CHAIRMEN FOR PACIFIC COAST INSTITUTE SECTIONS.—Chairmen for the eight Pacific Coast sections of the American Institute of Electrical Engineers for the new administrative year are: Denver, W. H. Bullock; Los Angeles, N. B. Hinson; Portland, H. H. Cake; San Francisco, L. F. Fuller; Seattle, L. N. Robinson; Spokane, Earl Baughn; Utah, A. C. Kelm; Vancouver, B. C., John Teasdale.

NEW SUBSTATION FOR VANCOUVER, B. C.—The British Columbia Electric Railway Company will build its second substation at North Vancouver, B. C., on Third and St. David Streets, just beside the existing substation. It will be of reinforced concrete and cost $84,000. The present substation will then furnish only energy for the street railway, while the new substation will take care of light and power requirements.

TWO MORE GENERATING UNITS FOR REMMEL DAM.—Two generating units will, it is reported, be added to the Remmel hydro-electric plant of the Arkansas Power & Light Company. These will be somewhat larger than the three units of more than 4,000 hp. each already in operation there. A year or more will be necessary for their installation, for which provision was made when the dam was built. The work will go on simultaneously with that on the company's 50,000-hp. Carpenter Dam project, also on the Ouachita River, near Hot Springs.

LOWER RATES AT FORT DODGE.—Reductions in rates, the second this year, which will amount to a saving of $27,000 to consumers, will become effective September 1 according to announcements made by the Fort Dodge (Iowa) Gas & Electric Company. The first slash brought a saving of $28,000. Residential rates have been reduced to 7 cents a kilowatt-hour for the first 50 kw.-hr., 3 cents a killowatt-hour for the remainder and a 50-cent monthly service charge.

PLANS FOR MORE POWER AT AUGUSTA, GA.—Plans of the Savannah Electric Power Company to modernize and electrify the Augusta (Ga.) canal have been approved by five of the leading mill executives affected, who use about 95 per cent of the power generated on the canal. These mills are now forced to stop at intervals because of the low water supply. It is probable that an election will be held to determine whether the canal is to be leased and its facilities brought up to date.

HOG FUEL PILE STORES 35,000,000 KW.-HR. — This pile of hog fuel, or sawmill refuse, containing 50,000 units (200 cu.ft. per unit) will be burned in one of the steam plants of the Portland (Ore.) Electric Power Company. It represents the generation of 35,000,000 kw.-hr., which is about the equivalent of 50,000 acre-ft. of water if

utilized in a plant under a head of 1,000 ft. at 70 per cent efficiency. Many Northwest power companies burn this hog fuel in steam plants to supplement hydro generation during low-water periods.

PECOS (TEX.) PLANT TO BE ENLARGED. — An addition to the Pecos (Tex.) power plant of the Texas-Louisiana Power Company is being constructed at a cost of $200,000. The original plant was completed two years ago at a cost of $500,000. Besides serving the oil fields, the transmission lines from this plant now furnish power to Toyah, Wink, Kermit, Barstow and Fort Stockton. A line has also been completed to the irrigated section south of Pecos.

ATTEMPTED COMPETITION AT FRANKLIN, TENN., BRINGS COURT ACTION.—A preliminary injunction restraining the Franklin (Tenn.) Power & Light Company from constructing an electric distribution system in Franklin has been granted the Southern Cities Power Company. The litigation follows a controversy between the Franklin company and the Southern Cities Power Company wherein the latter sought to have the utilities commission disapprove a franchise granted by the city of Franklin to the competing company. The commission has not yet acted.

ST. LOUIS NEEDS $4,000,000 MORE FOR STREET LIGHTING.—With the $8,000,000 voted for street lighting almost exhausted, St. Louis still feels the need for more modern lighting in nearly 40 per cent of the city's area, and about $4,000,000 additional will be required to complete its lighting system in north-central and northwest St. Louis and part of southwest St. Louis. The city is considering a new bond issue.

INTERNATIONAL WATER COMMISSION ADJOURNS.—After a series of sessions behind closed doors the International Water Commission, comprising three delegates each from the United States and Mexico, which assembled recently at Mexico City, adjourned at the close of last week, to meet again at Washington in the near future. A statement signed by the chairmen of the two delegations reported progress in the negotiations for an equitable distribution of the waters of the Rio Grande and the Colorado and Tia Juana Rivers.

GOSHEN PASS FIGHT GOES ON IN VIRGINIA. — Although the Virginia Public Service Company is understood to be proceeding with plans for the erection of a dam and power plant at Goshen Pass, an agreement has been reached between it and the Garden Clubs of Virginia to submit to the State Supreme Court the decision of the Corporation Commission that it has no authority in the matter. Scenery and historic site preservationists in Virgania, who have fought the proposed development vigorously, claim that the site involved, on the North River, is within the commission's jurisdiction.

PLAN TO LINK WEST COAST HYDRO PLANTS.—The People's West Coast Hydro-Electric Corporation has made application for a 50-year franchise to operate a 33,000-volt transmission line over the Ocean Beach highway between Ilwaco and South Bend, Wash., as the first step in a comprehensive linking of its properties. F. R. Nettleton, manager of the local property, says that an important part of the plans will be the Naselle hydro-electric project, which will supply energy for at least two counties. This project will be started as soon as engineering plans now under way are completed.

SUIT TO SET ASIDE MUNICIPAL PURCHASE OF UTILITY COMPANY PROPERTY.—Suit against the Wisconsin Hydro-Electric Company and certain officials and citizens of Durand, Wis., has been instituted in the federal court at La Crosse in which it is sought to prevent the passing of title to that portion of the company's property within Durand from the company to the city in accordance with a popular vote (398 to 333) last May. In the previous December the Wisconsin Hydro-Electric bought this property from the Durand Light & Power Company, and the charge is made that the agitation for municipal

ownership was part of a conspiracy aimed to upset the original sale of the company. The plaintiff is the Seaboard National Bank of New York, trustee for a bond issue floated by the purchasing company after that sale.

OREGON IRRIGATION DISTRICT WANTS TO DEVELOP POWER.—The Klamath Irrigation District, a southern Oregon project, has filed an application with the state engineer for a permit to appropriate 2,000 sec.-ft. of water from Klamath River for the purpose of developing electric power. This power would be used principally for operating irrigation pumps and furnishing electric service to settlers. The city of Baker asks the state for authority to store 1,780 acre-feet of water from Pine and Goodrich Creeks and to appropriate 21 sec.-ft. of such stored water for power and domestic purposes.

ELECTROCHEMISTRY IN ASTRONOMY AND AVIATION.—At the fifty-sixth convention of the American Electrochemical Society, to be held at Pittsburgh on September 19-21, Dr. Arthur S. King of the Mount Wilson Observatory, Pasadena, Calif., will describe an electric vacuum furnace developed by him to aid his investigation of the astral spectra. Other topics will be the interrelation of aëronautics and electrochemistry, the employment of the electric furnace in the production of iron almost 100 per cent pure by Dr. T. D. Yensen of the Westinghouse company, and the phenomenal progress of chromium plating.

MIDLAND UTILITIES INVESTMENT COMPANY BECOMES MIDLAND UNITED COMPANY.—The name of the Midland Utilities Investment Company of Chicago has been changed to Midland United Company. Similarity of the former name with those of other public utility holding companies was given as the reason for the change. The Midland United Company is an Insull-controlled holding or investment company, numbering among its subsidiaries the Northern Indiana Public Service Company, Interstate Public Service Company, operating subsidiaries of the Central Indiana Power Company and the Indiana Service Corporation.

PENNSYLVANIA-OHIO POWER & LIGHT ESTABLISHES INDUSTRIES DIVISION.—A new-industries division has been set up by the Pennsylvania-Ohio Power & Light Company, Youngstown, Ohio, to assist established industries and to attract new industries to the districts served by the company. C. E. Yacoll, in charge of the securities department of the Penn-Ohio Company, heads the new division. The company now serves nearly one hundred thousand consumers of electrical energy in the Mahoning Valley in Ohio and the Shenango Valley in Pennsylvania. In Ohio it serves Youngstown, Warren, Niles, Girard, Hubbard, Salem, Leetonia, Columbiana and Lisbon, and in Pennsylvania it supplies New Castle, Sharon, Greenville, Wheatland, Farrell, Sharpsville, Mercer and West Middlesex.

ONTARIO HYDRO HAS BUILT 650 MILES OF LINE SINCE JANUARY 1.—Engineers of the Ontario Hydro-Electric Power Commission have completed more than half of the year's building program of 1,000 miles of primary lines. There have been 650 miles of line constructed, which will serve more than 2,300 people. In eastern Ontario 157 miles of lines have been built. In the southwestern section 469 miles have been completed, and in the northern part 25 miles have been finished.

BEMIS ADVISES UTICA, N. Y., TO ACCEPT COMPANY'S PROPOSED RATES.—Dr. E. W. Bemis, engaged by Utica, N. Y., as a rate expert, has advised the city to accept the offer made by Floyd L. Carlisle on behalf of the Utica Gas & Electric Company at a public meeting held a short time ago. The reductions offered in the proposed new schedule are as follows: From 8½ cents to 7½ cents per kilowatt-hour for the first 30 kw.-hr. per month; from 6 cents to 5 cents for the next 70 kw.-hr.; from 4½ to 3 cents for all above 100 kw.-hr. The new schedule would result in a saving of $98,100. In addition penalties for tardy payment would be abolished. The commercial and small-power rates would be reduced approximately $100,000.

VALUATION MADE OF RICHMOND (IND.) PLANT.—A physical valuation of $2,723,454 has been placed on the municipal electric light plant at Richmond, Ind., by Earl L. Carter, former chief engineer of the Indiana Public Service Commission, who was engaged at the request of the citizens' advisory committee which co-operates with the city's board of public works and the plant management in the administration of the utility. This is the first valuation that ever has been placed on the plant since its construction, and it followed a public demand for a study to determine whether cuts in schedules might not be made, although Richmond now enjoys one of the lowest power rates in the state.

JAPANESE UTILITY OFFICIALS VISIT SCHENECTADY.—A group of seventeen prominent officials from the Japanese electric lighting and power companies, representing public utility companies with an aggregate capitalization of approximately $500,000,000, are expected to arrive in Schenectady on September 15 on a tour of the United States. Traveling under the auspices of the Tokyo Electric Company and the International General Electric Company, they are here to study modern lighting installations and methods and the administrative and engineering problems of central stations in this country. The party arrived in San Francisco on September 2 and will sail for Yokohama on November 7.

NEBRASKA ENGINEERS REPORT ON PLATTE VALLEY STORAGE SITES.—Members of the special commission of engineers named under authority of the Nebraska Legislature at the 1929 session have filed a preliminary report of their survey of possible sites in the Platte River Valley for a combination plan to insure flood-control and power development by means of storage basins. Sites near Bertrand and North Platte have received tentative indorsement. Because of lack of funds the survey will not take up details. Governor Weaver said that the federal government, which has a corps of engineers in the state engaged in flood control surveys, will be asked to amplify the work done by detailed surveys.

EMPIRE STATE ASSOCIATION WILL MEET NEXT WEEK AT UPPER SARANAC.—Thursday and Friday, September 19 and 20, are the dates for the twenty-fifth annual convention of the Empire State Gas and Electric Association, to be held at Upper Saranac, N. Y. Besides the reports of committees and of the seven sections of the association—Elec-

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue of July 6, page 46.]

Empire State Gas and Electric Association—Saranac Inn, Saranac Lake, N. Y., Sept. 19-20. C. H. B. Chapin, Grand Central Terminal, New York.

American Electrochemical Society — Hotel William Penn, Pittsburgh, Sept. 19-21. C. G. Fink, Columbia University, New York.

Illuminating Engineering Society — Bellevue-Stratford, Philadelphia, Sept. 24-27. A. B. Oday, 29 West 39th St., New York.

Great Lakes Division, N.E.L.A. — French Lick Springs, Ind., Sept. 26-28; Engineering Section, Lorain Hotel, Madison, Wis., Oct. 23-26. T. C. Polk, room 110, 140 South Dearborn, St., Chicago.

American Electric Railway Association —Atlantic City, Sept. 30-Oct. 4. J. W. Welsh, 292 Madison Ave., New York.

Association of Electragists International—New Ocean House, Swampscott, Mass., Sept. 30-Oct. 3. L. W. Davis, 420 Lexington Ave., New York.

National Safety Council — Stevens Hotel, Chicago, Sept. 30-Oct. 4. W. H. Cameron, 108 East Ohio St., Chicago.

National Electrical Manufacturers' Association—Wardman Park Hotel, Washington, Oct. 7-11. S. N. Clarkson, 420 Lexington Ave., New York.

American Society of Mechanical Engineers—National fuel meeting, Bellevue-Stratford Hotel, Philadelphia, Oct. 7-10. C. W. Rice, 29 West 39th St., New York.

Kansas Section, N.E.L.A. — Wichita, Oct. 17-18. H. Lee Jones, Kansas Gas & Electric Co., Wichita, Kan.

Public Utilities Association of West Virginia—Charleston, W. Va., Oct. 23-24. A. Bliss McCrum, P. O. Box 1483, Charleston, W. Va.

American Engineering Council—Mayflower Hotel, Washington, Oct. 24-25. L. W. Wallace, 26 Jackson Place, Washington, D. C.

Public Utilities Association of Virginia —Chamberlin-Vanderbilt Hotel, Old Point, Va., Nov. 21 and 22, A. B. Tunis, 306 Grace Securities Bldg., Richmond, Va.

tric, Commercial, Electric Meter, Accident Prevention, Accounting, Women's and Gas—addresses are scheduled by Albert W. Whitney, president National Bureau of Casualty and Surety Underwriters; Earl Whitehorne, McGraw-Hill Publishing Company; Dean William E. Mosher, Syracuse University; Matthew S. Sloan, president N.E.L.A.; Frances Perkins, New York State Industrial Commissioner; Randall J. Le Boeuf, Jr., former Assistant Attorney General; Senator S. C. Mastick and Colonel Oscar H. Fogg, president American Gas Association.

WESTERN ELECTRIC CONTRACTS FOR POWER AT BALTIMORE FROM CONSOLIDATED GAS & ELECTRIC.—The Western Electric Company has entered into a five-year contract with the Consolidated Gas, Electric Light & Power Company of Baltimore for the purchase from that company of all the electric power and steam to be used at the Point Breeze works of the Western Electric now under construction. The initial electrical demand will be for 17,500 kw.

NEW ORLEANS' NEW STREET-LIGHTING SYSTEM.—The long-planned ornamental street-lighting system for Canal Street, New Orleans, has taken its final shape and will, it is intended, be ready for the Mardi Gras of 1930. From the river, through the business section for a distance of over a mile, 108 handsome standards, with three 1,000-watt lamps on each, will be spaced to illuminate the 180-ft. street. The installation is being made by the New Orleans Public Service, Inc., and the lighting units and standards, as well as the scheme of lighting selected, were designed by the General Electric Company. A similar installation of 50 standards will be made on Rampart Street, and, in addition, a general reconstruction of the city's lighting system is to be carried out on an elaborate scale.

Commission Rulings

RURAL SERVICE CONNECTION CHARGE.—The Maryland Public Service Commission has with evident reluctance entered an order permitting the Suburban Electric Power Company to put into effect a service connection charge for village and rural customers which was considered by the company to be an advance payment for service. The commission said: "One feature of the proposed rate structure which is identical with the tariff now in effect and which has been regarded with doubt by the commission is a service connection charge considered by the company to be an advanced payment for service amounting to $205 for village customers and $315 for rural customers. The effect of the service connection charge upon cost of service depends upon the duration of the service and an analysis, based upon the company's estimate as to average consumption, namely, 540 kw.-hr. per year per customer at 10 cents per kw.-hr., with interest accrual at the rate of 6 per cent per annum, shows that a rural customer who pays the service connection charge of $315 will, at the end of eight years, have paid the same amount for service as the customer who elects to pay the higher energy rate of 20 cents per kw.-hr. If service be terminated earlier, he will have paid more per unit, and if continued longer than eight years, he will pay less per unit of service. . . . The commission is of the opinion that the use of a demand charge provides a more satisfactory form of tariff, and that is the form which should be adopted for permanent use. Therefore, in permitting the use of a service connection charge, it is regarded as a temporary expedient to facilitate and accelerate the extension of electric service under a project which has now been partially completed upon that basis, and when such purpose has been sufficiently served the use of the demand charge plan should be made exclusive."

INDIANA COMMISSION RESCINDS EXPRESSION FAVORING ORIGINAL COST AS BASIS OF VALUATION.—The decision of the United States Supreme Court in the St. Louis & O'Fallon Railway case has led the Indiana Public Service Commission to rescind an order outlining procedure in certain cases which was adopted last October. A new declaration by the commission, made in a case affecting the Central Indiana Power Company but embodying this recantation, says: "The declaration that the commission will consider only valuations based upon the original cost of the interurban, motor-bus and street-railway properties obviously is not in harmony with decisions of the Supreme Court of the United States which must be regarded as controlling in the valuation of public utility property, particularly the recently decided O'Fallon case. In order to arrive at a legal valuation in a matter of this kind, it is necessary to consider all pertinent evidence as to the value of the property involved, including evidence as to the cost of reproduction and the cost of reproduction depreciated. The O'Fallon case makes this very clear."

SHOULD ELECTRIC END OF JOINT GAS AND ELECTRIC COMPANY CARRY LOSSES OF GAS DEPARTMENT?—The Arizona Corporation Commission has permitted the Arizona Power Company to create a gas district and to establish an independent electric range rate in the territory served adjacent thereto. This is a departure from the commission's previous rulings and in explaining it it said: "Many years ago the commission permitted the establishment of gas districts in various parts of the state, within which districts the electric plant of the utility was permitted to absorb a portion of the loss incurred by the operation of the gas plant. This action by the commission has become a precedent, and however much the commission may approve the desire of the applicant herein to reduce voluntarily the electric rates to the power consumers within the gas district of Prescott, it may not consistently permit of this reduction if the subsequent operations of the utility would disclose a loss to the gas plant of so serious a nature as to demand an adjustment of the rates in order to produce the reasonable return on the gas plant which is contemplated by the constitution and the laws of the state, particularly where such adjustment must perforce be made at the expense of the electric consumers. It appears from the testimony given by the company that, considered alone, the rate is obviously reasonable and would accrue to the benefit both of the consumers and the applicant. Therefore the commission is loath to withhold its approval. One solution presents itself; that is, if the commission waives its rule as heretofore applied to the establishment of gas districts and permits the rate to become effective, the direct loss incurred by the gas plant must be absorbed by the gas plant without the resultant deficit in the earning of a reasonable return upon the gas plant being directly or indirectly absorbed in the earning of a reasonable return by the joint electric plant. It will be necessary, therefore, for the applicant so to keep its records that the revenues and expenses of the electric plant within the established gas district are readily obtainable as distinguished from the revenues and expenses of the electric plant outside of the gas district. With this understanding the proposed rate is approved."

Recent Court Decisions

TAKING HOLD OF DROP CORD WHILE STANDING ON STOVE THROUGH WHICH WATER PIPE RUNS NOT NEGLIGENCE.—Contributory negligence could not be argued in a case where a girl standing on a stove took hold of an imperfectly insulated drop cord and was killed, presumably, it was argued, because the stove contained a water pipe with which a grounding took place. Nor could it be established because in falling she jerked the wire from the socket. This was the dictum of the Court of Appeal of Louisiana in Bel vs. Louisiana Power & Light Company. In this damage case the plaintiff maintained that through the negligence of the company the victim received a charge of 2,300 volts. Testimony that the company's primary and secondary wires touched the same limb of a tree and were only one inch apart was held to establish the negligence of the company, which, the court declared, was obligated to know the condition of its property and keep it safe. (123 So. 396.)*

INFERENCE OF NEGLIGENCE CANNOT PREVAIL WHERE DEFENDANT COMPANY SHOWS ITS EQUIPMENT TO HAVE BEEN STANDARD.—A verdict for plaintiff in Edwards vs. Cumberland County Power & Light Company was set aside by the Supreme Judicial Court of Maine. The case involved damages claimed for the destruction of a dwelling by fire because, as alleged, the company's transmission line broke and, coming in contact with the service wire, transmitted high-voltage electricity to the building. It was also declared that the transmission wires sagged owing to the interval between poles facing the house being too great. The reviewing court held that evidence showed the company's equipment to be of standard pattern and approved construction and, asserting that the company had not been proved to be negligent, ordered a new trial. Any inference of negligence making a *prima facie* case, the court said, cannot avail the plaintiff in the face of such opposing evidence as was introduced. Negligence is for the court to determine when evidence is so clear that reasonable minds would not differ. (146 At. 700.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Electrical Men

Charles Webster Heads Utilities Commissioners

Charles Webster, a member of the Iowa Railroad Commission for the past twelve years, was elected president of the National Association of Railroad and Utilities Commissioners, which met recently in Glacier National Park, Montana. A native of Iowa, Mr. Webster early in his career engaged in the lumber, grain and livestock business in that state and North and South Dakota and subsequently he helped to finance electric light, telephone and gas companies at Prescott, Ariz. He was a delegate to the Republican national convention that nominated President Taft the first time and during the war he was a member of the state council of defense and federal fuel administrator for Iowa. Mr. Webster has been prominently identified with the activities of the National Association of Railroad and Utilities Commissioners for a number of years.

JOHN S. RIDDILE, who for nearly ten years was connected with Ralph D. Mershon in hydro-electric development in Canada, has been appointed executive engineer of the Shawinigan Water & Power Company, which last year purchased the Laurentide Power Company, Ltd., Grand Mere, with which Mr. Riddile was formerly identified.

DR. MORTON G. LLOYD, chief of the section on safety standards of the Bureau of Standards, has left on a trip to the Pacific Coast for the purpose of consulting with state public utility commissions, state officials, insurance officers and others interested in problems of safety with particular reference to electrical service. During this trip he will attend conventions in Vancouver and San Francisco held by local sections of the International Association of Electrical Inspectors and will talk on the subjects of electrical wiring and the practice of grounding electrical circuits and equipment for protective purposes, and more particularly with that part of the bureau's work which is of interest to the electrical industry.

I. F. BAKER, formerly power division sales manager of the Westinghouse Electric International Company with offices in New York, has been appointed European sales manager with headquarters in London, England. Mr. Baker's career with Westinghouse has been colorful and his duties and experiences widely varied. Starting with the industrial sales department at East Pittsburgh, he was transferred to the Westinghouse Export Company in that city and then to the New York office of the Westinghouse Electric International Company as commercial engineer. The following year he was sent to Japan and in 1925 he was appointed managing director of the Japan Company, the position he held until 1927. His appointment to manager of the Far Eastern department of the Westinghouse Electric International Company brought him back to the New York office, and a short time later he was made power division manager of the International company.

Colonel Tyler in Washington

Colonel Max Tyler, the new chief engineer of the Federal Power Commission, arrived in Washington September 2 to take over the duties of his new assignment. Colonel Tyler is best known for the recently completed water system for the capital city. During the same period, while he was serving as district engineer at Washington, Colonel Tyler reported on the hydro-electric possibilities of the Potomac. As a result of his study he reached the conclusion that the power resources of the river could be developed to advantage. For the past two years Colonel Tyler has been department and district engineer in the Philippines. He is widely known for the work he did in connection with the contruction and operation of the Muscle Shoals project. In addition, he served for four years on the Ohio River project.

J. F. Ford New President Pennsylvania Association

John F. Ford, assistant controller of the Philadelphia Electric Company, was elected president of the Pennsylvania Electric Association at the recent convention held in Bedford Springs. Mr. Ford has been in the employ of the Philadelphia utility since 1910. In 1912 he was made supervisor of the tabulating section of the controller's department and two years later was promoted to the position of supervisor of the accounts payable auxiliary general ledgers. From the fall of 1917 until 1926 he served as manager of the customers' accounts division, when he was appointed assistant controller. Mr. Ford is well qualified to head the Pennsylvania Electric Association, having engaged extensively in committee work for that organization as well as for the National Electric Light Association. Last year he was chairman of the Accounting National Section of the N.E.L.A.

Obituary

ALBERT E. SMITH, controller and assistant secretary of the Electric Bond & Share Company, died September 1 at the Fifth Avenue Hospital in New York City. Born in 1876, Mr. Smith became one of the original members of the Electric Bond & Share Company organization when that company was formed in 1905, and he continued to be associated with the company until his death. Since association with the company Mr. Smith had held the offices of assistant treasurer, assistant secretary and treasurer and since 1918 he had been controller and assistant secretary.

HENRY FISHER, capitalist of Redlands, Cal., who was prominently identified with the early construction work on three-phase hydro-electric plants in the United States for long-distance transmission, died suddenly September 7 at Santa Barbara, in his eighty-sixth year. Mr. Fisher was active in public utility affairs in California some few years ago. He organized the Redlands Street Railway and the San Bernardino Valley Traction Company and later became president of the Redlands Electric Light & Power Company, the parent company of the Southern California Edison Company. He was a director in the latter company until eight years ago, when his son, John H., took his place. Early in his career, which began at Oil City, Pa., in 1864, he was interested in the petroleum industry.

WALTER CLARK FISH, electrical engineer, and formerly general manager of the Lynn, Mass., plant of the General Electric Company, died September 8 at his home in Boston, Mass., following an illness of several years. Mr. Fish was born at Taunton, Mass., 65 years ago and matriculated at Harvard University and the Massachusetts Institute of Technology. He became connected with the Thomson-Houston Company, Lynn, now the General Electric Company, and was in the research laboratory with Professor Elihu Thomson. In 1888 he was representative in Europe for the Thomson Electric Welding Company and successfully introduced this system of welding. In 1890 he returned to this country. In 1920 he resigned from the General Electric Company to affiliate himself with the International Electric Company with headquarters in Paris. In 1922 he returned to this country and again joined the General Electric Company as consulting engineer, a connection which called for his services on many important foreign development projects. He retired from active practice in 1924. He was a member of the American Institute of Electrical Engineers, Boston Engineers' Club and of other technical societies.

Financial and Statistical News

"IT'S A YOUNG MAN'S MARKET. I don't understand it. I don't see any reason in it." This is what a veteran member of the New York Stock Exchange said to ELECTRICAL WORLD this week, referring especially to utility stocks. Certainly numerous factors in the market today were not there a decade ago.

——ONE OF THESE IS THE CURRENT FLOTATION of huge holding and investment units primarily or extensively interested in utility securities. These work two ways. They presuppose the confidence of executives and their bankers and, on the other side, they constitute the major factor in supporting a utility market.

——UTILITY EXECUTIVES ARE KEPT BUSY DENYING the numerous merger rumors heard around the Street these days. Some, however, are definitely shaping up.

Commonwealth & Southern to Pay Stock Dividends

Directors of the Commonwealth & Southern Corporation have determined on a policy of stock dividends instead of declaring cash dividends. In a letter sent to stockholders B. C. Cobb, chairman of the board, said:

"In lieu of declaring dividends in cash on the common stock of the corporation, the directors deemed it to be to the interest of the stockholders to reinvest the equivalent in the business of the corporation, and therefore inaugurated the policy of distributing dividends in additional common stock. An initial quarterly dividend of one-eightieth of a share with respect to each share of common stock of record at the close of business August 1, 1929, was declared distributable Sept. 3, 1929, being at the rate of 5 per cent per annum. The shares distributed on such dividend have been set up in capital account at the stated value of $5 per share and a corresponding charge made to earned surplus."

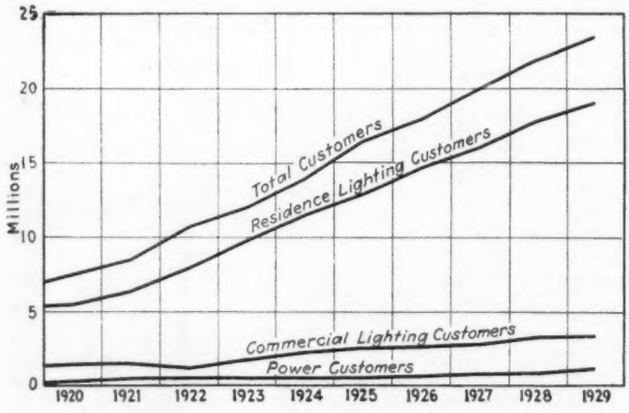
New Utility Investment Company Organized

United Founders Corporation, American Founders Corporation, Hydro-Electric Securities Corporation, Albert Emanuel Company, Inc., Harris, Forbes Corporation, A. C. Allyn & Company, W. C. Langley & Company, Seaboard National Corporation and others have just formed the United States Electric Power Corporation to acquire holdings in public utilities. The capitalization of the company consists of 1,000,000 shares of preferred, 2,000,000 shares of class A and 20,000,000 shares of common stock, all of no par value. Rights to purchase at $15 one common share, with warrant, will be given for each five shares of United Founders Corporation common and for each 2½ shares of American Founders Corporation common of record of September 14. The rights will expire October 15. The warrants are non-detachable from the common stock of the United States Electric Power Corporation and evidence the right to purchase an equal number of shares of common at $25 a share on or before January 2, 1940.

Louis H. Seagrave, president United Founders Corporation, is chairman of the new company and Victor Emanuel, president Albert Emanuel Company, Inc., is president.

One Reason for Up-Swing in Utility Prices

Skeptics with regard to justification of current price levels in the utility markets are not few. The attached chart illustrates one reason for these steadily rising prices. The most frequent reason given for the rising quotations is the heavy buying on the part of investment trusts and the public, discounting future possibilities. To what extent these future possibilities should properly be discounted is a matter of no unanimity of opinion, but the growth of the industry for a decade shows a trend which may reasonably be expected to continue with the extension of power and light facilities and the campaigns of central stations for additional customers.



Growth in Electrical Customers

Many of the utility stocks were almost stationary for years and were decidedly undervalued. The present rise is less spectacular if a ten-year average corresponding to the ten-year increase in customers be studied.

The chart, of course, does not take account of the increase in load sold to individual customers.

Investment Trusts Put Capital in Expert Hands

Discussing various phases of the investment trust movement in the United States, Stone & Webster and Blodget in their current letter say:

Up to the present time most of the investment companies in America, unlike the British investment trusts, have operated only in periods of prosperity. Many of the British and other foreign investment trusts, however, have emerged successfully from periods of war, business depression and drastic declines in security prices.

Looking ahead, the effect of the concentration of capital in American investment companies should be helpful, regardless of what circumstances may arise. The investment trust has resulted in the placing of several billions of dollars in investment capital of this country in expert hands. At the same time it has afforded opportunity to the smaller investor to put his funds into a large number of different companies, well nigh impossible before the advent of the investment trust.

The underlying principle upon which a sound investment company is operated is to buy security values rather than prices. If you buy values, based upon analyses by expert and trained minds, the steady growth of the United States makes possible the future enhancement in the value of security holdings irrespective of periods of temporary market weakness.

Aside from giving direct benefit to the individual security holder, the investment trust has also contributed a constructive force to security markets in general. A stabilizing influence has been exerted through the policy of well-managed trusts in analyzing values irrespective of market quotations and in placing orders for securities at levels below current prices. These orders support the market in time of stress when a wave of excessive selling tends to unduly depress security prices below their true level. Well-conducted investment companies always maintain a proper relationship between their cash position and the investment in their portfolio, thereby keeping themselves in a position to benefit from price reactions caused by technical conditions of the market rather than by conditions affecting the actual value of the securities.

New Capital Issues

Midland United Company
Common stock.
Amount, 350,000 shares.
Price, $21 per share.

The Midland United Company, formerly the Midland Utilities Investment Company, is an Insull holding company owning and controlling public utility companies serving 662 communities in Indiana, Ohio and Michigan with an estimated population of 1,515,941. Capitalization of the company, after giving effect to the present financing, will consist of 2,242,295 shares of no-par common stock and 83,893 shares of series 1 and 57,200 shares of series 2 no-par preferred stock. The company has no funded debt. The entire outstanding preferred and common stocks of the company, except for this issue, are owned or controlled by Commonwealth Edison Company, Peoples Gas Light & Coke Company, Public Service Company of Northern Illinois and Middle West Utilities Company. Proceeds from the sale of this issue will be used in furtherance of the construction programs of subsidiaries, and for other corporate purposes, including reimbursement for expenditures already made in the purchase of securities of subsidiary and other companies.

Central States Electric Corporation
5½ per cent optional debentures.
Amount, $25,000,000.
Price, 99½ and accrued (cash) interest.
Feature, common stock purchase warrants accompany debentures.
Due date, September 15, 1954.

Central States Electric Corporation was organized in 1912. It is the largest single stockholder of the North American Company and has a controlling interest in the class B common stock of the American Cities Power & Light Corporation, as well as a substantial investment in the common stock of the Electric Shareholdings Corporation. Each debenture will carry a stock purchase warrant, detachable on or after March 15, 1930, entitling the holder to purchase, on or before Sept. 15, 1934, ten shares of common stock of the company at prices determined by the order in which the warrants are exercised.

General Gas & Electric Corporation
$6 cumulative preferred stock, series B.
Amount, 150,000 shares.
Price, $99 per share and accrued dividend, yielding 6.06 per cent.
Feature, convertible into common stock.

The General Gas & Electric Corporation has investments in Associated Electric Company, Associated Gas & Electric Company, Broad River Power Company, Central Massachusetts Power & Light Company, Eastern Utilities Investing Corporation, Edison Electric Illuminating Company of Boston, Florida Power & Light Corporation, Florida Public Service Company, Lexington Water Power Company, Massachusetts Lighting Companies, New England Power Association, Southern Berkshire Power & Electric Company, Southeastern Massachusetts Power & Electric Company, Utilities Power & Light Corporation, Western Massachusetts Companies, and the Worcester Suburban Electric Company. The proceeds derived from the sale of this preferred stock will be used for carrying out the present expansion plans of the company. Each share of this stock will be convertible at the option of the holder at any time after May 1, 1930, and before May 1, 1935 (or, if called for redemption before May 1, 1935, up to but not after the tenth day before the redemption date), into one and one-tenth shares of the common stock, class A.

New Utility Holding Company Organized

The organization of a newly formed utility holding corporation to be headed by Floyd W. Woodcock of Philadelphia, vice-president and a director of Day & Zimmermann and connected with other utility companies, has been announced. The name of the new corporation will be the Empire Corporation. It will acquire controlling and minority interests in public utility companies. The authorized capitalization will be 500,000 shares of preferred stock of no par value and 2,500,000 shares of common stock of no par value. The corporation has acquired more than 87 per cent of the class B common stock of the Empire Public Service Corporation and also has contracts to purchase common stocks of companies which own directly or indirectly public utility properties valued at more than $7,500,000.

The Empire Corporation will offer shortly 50,000 units in the form of allotment certificates, each unit consisting of one share of preferred stock, one share of common stock and one option warrant. In addition it will offer 50,000 shares of common stock. On completion of initial financing the corporation will have assets totaling $9,500,000 and will control properties worth more than $35,000,000.

Mammoth Trusts Play Larger Part in Utility Field

AMERICA'S newest fashion in high finance—the investment trust—is playing an increasingly important part in the utility field. These institutions are not only the most important current buyers of utility stocks but they are powerful instruments in welding the industry into new alignments and consolidations. Rumor has it that Shenandoah Corporation, sponsored by the Harrison Williams-Goldman Sachs interests, may play an important part in welding together the Pacific Coast utilities. This assumption is merely a conjecture based on the published portfolio of Shenandoah Corporation, which shows large holdings in Pacific Gas & Electric Company, Pacific Lighting Corporation and Southern California Edison Company.

Shenandoah an Example

With net assets on September 4 having a market value of more than $250,000,000, the Shenandoah Corporation, which has invested heavily in public utility stocks, is by no means a small factor in the market. In addition to the utility stocks mentioned, it has large holdings in the Central States Electric Corporation, American Telephone & Telegraph Company, Consolidated Gas, Electric Light & Power Company of Baltimore, Electric Investors, Inc., Hydro-Electric Securities Corporation and the North American Company.

While rumors of the Pacific Coast tie-up have been prevalent for some time and have been officially denied by officers of the company in question, the potentialities of an organization such as Shenandoah along these lines are obvious. In addition to Harrison Williams, the board includes Clifford S. Stone, Waddill Catchings, Sydney J. Weinberg and John Foster Dulles.

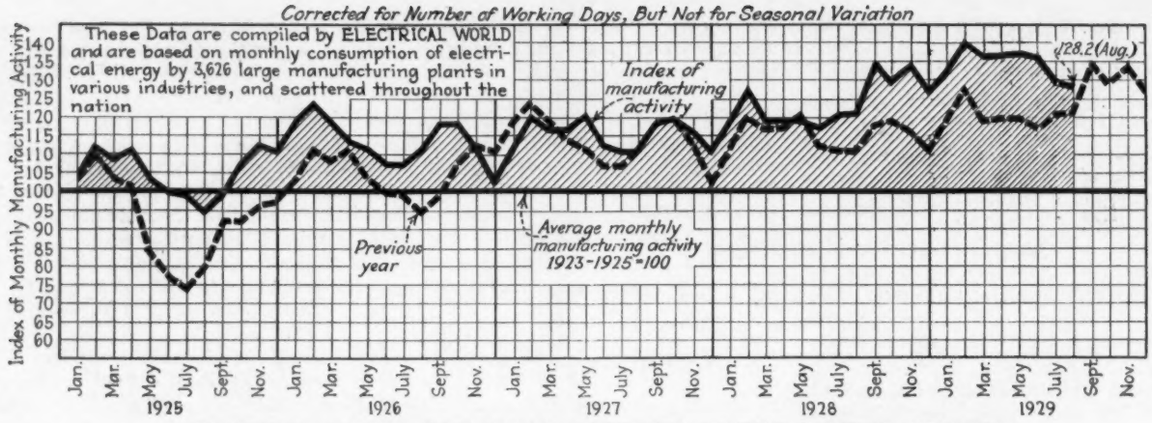
August flotations of investment trusts totaled around $375,000,000 and several large new trusts are now in course of formation, based, presumably, on the buoyancy of the markets. Sponsors of these institutions state that a bull market is a requisite for the successful distribution of investment trust securities.

Utility Stocks Sell Over 31 Times Earnings

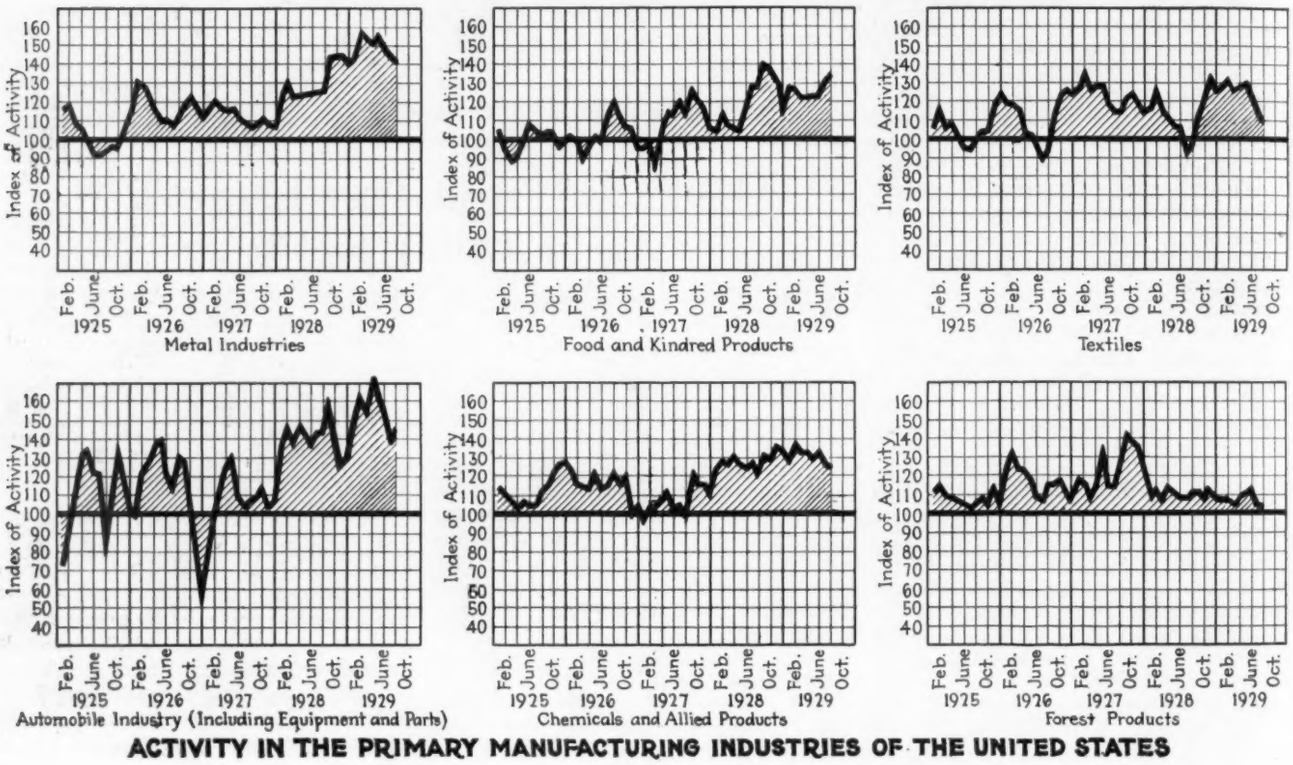
The attached study of a representative group of active stocks indicates the level of present quotations in relation to last year's earnings. The six holding company stocks have an average of 34 times last year's earnings per share.

Holding Companies	Earned 1928	Market Range 1928 H.	Market Range 1928 L.	Closing Price Sept. 5	Ratio Price to 1928 Earnings
American Power & Lt.	$4.49	95	62	161	36
Electric Pwr. & Lt.	2.37	49	28	74	31
North American Co.	4.51	97	58	172	38
Public Service of N. J.	3.28	83	41	119	36
Engineers Public Service	1.78	51	33	71	39
Standard Gas & Electric	6.57	84	57	171	26
Commonwealth Edison	12.33	220	165	370	30
Consol. Gas of New York	4.52	113	74	171	38
Detroit Edison	12.24	224	166	348	28
Pacific Gas & Elec.	3.05	56	43	90	29
Pub. Service of Northern Ill.	14.32	205	158	360	25
Consol. Gas of Baltimore	5.49	96	67	135	25
Average					31.75

while the six operating company stocks average about 29 times last year's earnings. The rapid upward trend of these stocks during the first half of the current year is illustrated by the difference between the market range for 1928 and the closing price of September 5.


Corrected for Number of Working Days, But Not for Seasonal Variation
These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
Index of manufacturing activity
128.2(Aug.)
Previous year
Average monthly manufacturing activity 1923-1925=100
Index of Monthly Manufacturing Activity
1925
1926
1927
1928
1929

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES



ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Seasonal Manufacturing Curtailment

MANUFACTURING operations of the country in August based on consumption of electrical energy were about 0.6 per cent under those of July, but were 6.1 per cent above August, 1928, according to reports received from more than 3,600 manufacturing plants by the ELECTRICAL WORLD. The average daily rate of activity was of record proportions for the month of August in the chemical products, food products, rolling mills and steel plants, ferrous and non-ferrous metal-working plants, stone, clay and glass industrial groups.

Consumption of electrical energy by the rolling mills and steel plants was on a plane 4.5 per cent above that of July and 20.4 per cent above the August issue of last year. The August rate of operations was about 12.4 per cent under the peak month of May. Ferrous and non-ferrous metal-working plants, taking the country as a whole, report a rate of operations in August that was about 6.5 per cent under July, but 7 per cent above August, 1928.

For the second consecutive month the automobile industry, including the production of parts and accessories, reported a rate of operations under that of the same month last year, although a gain of about 2.5 per cent was recorded during August as compared with July. The high mark in this industrial group was recorded last April, the current operations being about 16.2 per cent under the record set in April.

The textile industry recorded a seasonal drop of about 3 per cent as compared with July operations, but August activity was still about 13.1 per cent over August last year.

Besides the automobile industry, three other industrial groups—lumber products, paper and pulp and rubber products—recorded August operations at a rate under those of August last year.

Every section of the country reports a higher rate of operations than in August last year. Increases over August last year were: New England, 6.4 per cent; Middle Atlantic, 7.7 per cent; North Central, 5.5 per cent; South, 17.7 per cent, and the Western States, 1.4 per cent.

AMERICAN COMMONWEALTHS POWER ON STOCK DIVIDEND BASIS.—Following a meeting of the board of directors of the American Commonwealths Power Corporation held recently the announcement was made that the company would adopt a stock dividend basis in lieu of any cash dividend and in the event of a cash dividend such dividend would be in the form of an extra dividend to that paid in stock. Stockholders of record October 1, 1929, both class A and class B common, will be placed on a 10 per cent stock dividend basis, the first quarterly payment to be made October 15.

Business News and Market Conditions

National Electric Exposition Plans Making Progress

NOTHING but electrical equipment will be featured at the National Electric Exposition to be held in Grand Central Palace, New York, October 7 to 12. The organizers have already signed ninety of the highest type manufacturers of electrical equipment and are attracting wide attention from the industrial user and domestic consumer of electrical current. It is hoped that the greatest gathering of electricity-using industries, jobbers and distributing trades, contractors and the domestic appliance buying public ever attracted to a show of this kind will be present.

Included in the diversified field of exhibitors who have already reserved space are: Schedule or installation material, lighting fixtures, radio equipment, mechanical tools, therapeutic equipment, timepieces, household utilities, service organizations, contractors' supplies, utility appliances and precision instruments.

The men in charge of the exposition are: Theodore H. Joseph, chairman, E-J Electric Installation Company; S. E. Kimball, Kimball Electric Company; W. B. DeForest, Graybar Electric Company; Harry A. Hamft, electrical contractor; W. B. Pierce, Edison Electric Appliance Company; Hugo Tollner, Tollner Electric Company; W. S. McClure, New York Edison Company, and Earl Whitehorne, president of the Electrical Board of Trade of New York and the New York Electrical League. Fred W. Payne and Charles F. Roth are co-managers of the exposition.

Copper Much Quieter in Metal Markets

The phenomenal market in copper proved to be short-lived, sales in the past week being only about normal and at unchanged prices. The higher prices and heavy demand for lead have been the feature of the non-ferrous metal market. Zinc and tin have been even quieter than they have in recent weeks, but it is thought that consumers of these metals are underbought and that a satisfactory market may be expected in the near future.

NEW YORK METAL MARKET PRICES

	Sept. 4, 1929 Cents per Pound	Sept. 11, 1929 Cents per Pound
Copper, electrolytic	18	18.25
Lead, Am. S. & R. price	6.75	6.90
Antimony	8.75	8.75
Nickel, ingot	35	35
Zinc, spot	7.15	7.15
Tin, Straits	45.38	45.38
Aluminum, 99 per cent.	24.30	24.30

When consumers found last week that a sustained effort was being made by most sellers to keep the copper market at 18 cents, for Connecticut deliveries, and that large supplies of the metal were being offered at that level, their demands moderated considerably.

National Power Show

At the eighth National Exposition of Power and Mechanical Engineering, known as the National Power Show, to be held in Grand Central Palace, New York City, during the week of December 2, the manufacturer and operating engineer will find instruments of great variety and importance.

It is a well-known fact that many power plants, boiler rooms and mechanical departments are almost hopelessly out of date, that the owner's operating costs are mounting and profits are correspondingly decreasing.

To superintendents and operating engineers of such plants the National Power Show should have a special appeal as a means of informing themselves on the latest phases of power plant equipment and by comparison with their own plant needs be in a position to go to their superiors with a definite plan of rehabilitation, thereby establishing savings in operating costs and more satisfactory operation.

CONVENIENT OUTLET MONTH.—September has been set aside as "Convenient Outlet Month" by the National Electric Light Association. During the month many central stations are making a concentrated effort to install thousands of new outlets.

National Prosperity—Its Cause*

BY M. S. SLOAN

President National Electric Light Association

COINCIDENT with our recent great industrial development has come a notable improvement in our national standards of living, which are a marvel and an example to other nations. More than other nations, we have adopted the policy of paying wages in accordance with output. The individual whose productive capacity has been multiplied by electrically powered machinery gets his reward in a heavier pay envelope. Accordingly, he has been able to spend more for goods and services obtainable at the lower prices made possible by mass production and mass merchandising.

Hence the well-fed, well-clothed, well-housed American with whom we are familiar, driving his own car, owning a good radio receiving set and many other articles of luxury entirely out of the reach of the average worker of past generations. Hence the remarkable increase in enrollment in high schools, colleges, technical schools and universities, for this American worker with a comfortable bank account believes in providing a good education for his children.

NOT CONFINED TO BUSINESS

Julius H. Barnes of the U. S. Chamber of Commerce has pointed out that in 1890 our national per capita income was $192, while in 1928 it was $750. In 1900 the per capita deposits in savings institutions were $46; in 1928 they were $237. In 1900 there were 8,000,000 depositors, while the $28,500,000,000 in 1928 belonged to more than 53,000,000 depositors. In 1900 there were 8,000,000 life insurance policyholders having $8,500,000,000 insurance, while in 1928 there were 65,000,000 policyholders having $96,500,000,000 in policies.

These figures show strikingly how our nation's prosperity has become a matter of individual prosperity. For this the power and light industry can claim at least a part of the credit, since it is one of the basic elements in the situation, producing large output, wide distribution of goods, low prices and high wages.

**Excerpts from address before New England division, N.E.L.A.*

Market Conditions

EQUIPMENT BUSINESS was quieter last week on the Pacific Coast but decidedly more active in the East and in most sections of the interior. Pacific Coast producers report standard transformer and motor sales well above 1928 totals.

——MOTORS AND MISCELLANEOUS EQUIPMENT are moving well in the Middle West and Southwest.

——THE EAST AND SOUTHEAST report record commitments for this season. An exceedingly satisfactory autumn business is anticipated in these districts.

SOUTHEAST

THE EXPECTED fall pick-up in electrical activities was noticeable last week with a good volume of business reported. With the exception of Florida, which is quiet, all states in this section are showing a satisfactory activity and prospects for the next few months are bright.

One company ordered last week switching equipment totaling $66,000, most of this being for disconnect switches, though a small portion was for air break switches. Expansion activities of the larger companies are responsible for a satisfactory amount of line material orders, some of the larger orders being for 60,000 lb. of No. 2 weatherproof copper, creosoted pine poles amounting to $9,000, pole-line hardware totaling $7,600, cable costing $8,200 and small power and distribution transformers amounting to $5,500. A Carolina power company ordered power transformers costing $8,000 and a Florida company ordered 10,000 lb. of bare copper wire. Some line construction material orders are pending in northwest Florida. An aluminum plant in Tennessee placed orders last week for power transformer equipment aggregating $145,000. Construction projects follow:

Model Mill Company, Johnson City, Tenn., plans feed and grain mill to cost about $100,000. Buckeye Cotton Oil Company, Cincinnati, Ohio, plans plant at Memphis, Tenn., to cost more than $100,000. Plough Chemical Company, Memphis, Tenn., will receive bids until September 21, for plant unit to cost $1,000,000. Liberty Range Works, Inc., Nashville, Tenn., plans plant to cost $200,000. Southern Silk Mills, Inc., Greensboro, N. C., plans plant at Kernersville, N. C., to cost $150,000. Sonoco Products Company, Hartsville, S. C., will build an addition to paper products plant to cost $80,000. Lockhart Power Company, Union, S. C., plans construction of transmission line to Sedalia, West Springs and vicinity, to cost more than $25,000. Mississippi Power & Light Company, Jackson, Miss., is considering extensions in transmission lines at Durant, Miss., and vicinity to cost more than $85,000. Gulfport, Miss., plans installation of floodlighting system in connection with extensions at municipal airport. Continental Gin Company, Birmingham, Ala., plans addition to cotton gin machinery plant to cost about $100,000. Georgia Power Company, Atlanta, Ga., has approved plans for extension in power substation at Cartersville, Ga., to cost about $60,000. Simpson & Morgan Ice & Coal Company, Rockmart, Ga., plans electric-operated ice-manufacturing plant to cost about $50,000. J. W. Ross, Jacksonville, Fla., plans ice-manufacturing plant in vicinity of Lake Wales, to cost about $150,000. Nevins Fruit Company, Cocoa, Fla., plans ice-manufacturing and pre-cooling plant at Titusville, Fla., reported to cost $30,000.

SOUTHWEST

THE STEADY buying trend which has characterized the electrical industry in the St. Louis district has continued for the past week and all manufacturers are optimistic in predicting a good volume of business for this autumn and winter.

An order was placed by a large lead mining company for $15,000 worth of transformers and switching equipment, one of the power companies placed orders for distribution transformers aggregating nearly $16,000, a southeast Missouri power company bought transformers and regulating apparatus to cost $10,000 and other orders reported include miscellaneous control equipment for a large synchronous motor installation amounting to $3,400, a lot of motors for a new shoe factory and an order for two carloads of crossarms to cost $2,000. Construction projects follow:

Tulsa Cement Company, Tulsa, Okla., plans cement mill to cost $1,000,000. Woodward, Okla., contemplates floodlighting system and beacon lamps at proposed municipal airport. Southwestern Gas & Electric Company, Shreveport, La., plans extensions in transmission lines at Avoca, Alpena, Ark., reported to cost about $35,000. Home Fertilizer Company, Texarkana, Ark., plans plant at Conway, Ark., to cost about $75,000. Central Power & Light Company, San Antonio, Tex., plans transmission line from Brackettville to Spofford, Tex., and vicinity, reported to cost about $24,000. Farmersville, Tex., has authorized installation of a municipal electric light and power plant to cost about $45,000. Tidal Refining Company, Houston, Tex., plans oil refinery at Ingleside, near Houston, to cost $800,000. Texas Power & Light Company, Dallas, Tex., contemplates extensions in transmission lines at Neches, Tex., and vicinity. Louisiana Ice & Utilities, Inc., Alexandria, La., has plans for ice-manufacturing plant to cost about $40,000.

MIDDLE WEST

GENERAL business in the Middle West section continues on an even, satisfactory basis. Volume is holding up well and indications point to brisk fall business. The major activities, steel, automotive and railroad industries are in excellent shape and reports from agricultural districts are encouraging. The various utility companies are busy with a large amount of circuit revision and line extension work, while considerable new construction work is going on.

Some of the interesting orders placed this week include three motor-driven and two turbine-driven boiler feed pumps valued at $44,000, steel circulating water piping valued at $42,000, four 72-in. sluicegates, cast-iron circulating water fittings valued at $21,000, heating and evaporating equipment valued at $48,000, four heater drain pumps, three 2,000-kva. O.I.W.C. single-phase, 60-cycle, 12,000-volt power transformers, twenty-five 37½-kva., single-phase, 2,300-volt pole type distribution transformers, 300,000 lb. of copper busbar and 600,000 lb. of triple-braid weatherproof wire and cable. Construction projects follow:

Simmons Company, Kenosha, Wis., will build addition to metal bedstead plant to cost about $100,000. Page Steel & Wire Company, Adrian, Mich., will make plant extensions to cost $100,000. Clark Equipment Company, Buchanan, Mich., contemplates addition to automobile equipment plant to cost about $75,000. Public Lighting Commission, Detroit, Mich., has filed plans for extensions and improvements in power plant to cost $45,000; plans have been approved for an equipment storage and distributing plant to cost $35,000. Wolverine Bolt Company, Detroit, Mich., plans addition to cost $85,000. Hayes Body Corporation, Grand Rapids, Mich., plans addition to automobile body manufacturing plant to cost $100,000. Grand Trunk Railway Company, Detroit, Mich., has approved plans for a power plant and shops for locomotive repair at Pontiac, Mich., to cost $100,000. Ajax Quilting Company, Chicago, Ill., has filed plans for addition to cost $125,000. Burton Spring Manufacturing Company, Chicago, Ill., plans plant to cost $60,000. Chicago Sausage Company, Chicago, Ill., will build a packing plant to cost $250,000. Edison Electric Appliance Company, Chicago, Ill., plans addition to cost $300,000. Ogden Phonograph Company, Chicago, Ill., plans an addition to plant to cost $80,000. Caterpillar Tractor Company, East Peoria, Ill., plans power plant to cost $150,000. Northwestern Terminals Company, Evansville, Ind., plans coal-handling and distributing plant to cost about $100,000. Hilton-Davis Company, Cincinnati, Ohio, is considering plans for chemical plant to cost $100,000. Randall Company, Cincinnati, Ohio, plans expansion program at machinery plant to cost over $100,000. Eaton Axle & Spring Company, Cleveland, Ohio, plans addition to cost about $75,000. Seagrave Corporation,

Columbus, Ohio, has filed plans for addition to fire fighting equipment plant, to cost close to $50,000. Inland Manufacturing Company, Dayton, Ohio, plans addition to automobile equipment plant to cost $100,000. Newark, Ohio, contemplates floodlighting system and beacon lamps in connection with proposed municipal airport to cost about $100,000.

Pacific

Business is perceptibly quieter on the Pacific Coast, with few large jobs under actual construction. Machinery manufacturers, however, report a better year to date than last because of standard transformer and motor sales, which show no signs of decrease despite the lateness of the season.

Although central station buying was comparatively light during the past month in the Puget Sound area dealers are optimistic for the immediate future. Specifications are expected for several substations and for replacement of considerable equipment in existing plants. Industrial buying is on the increase and range sales are reported exceptionally good. Westinghouse reports a $20,000 sale of high-tension insulators for a southern California installation, a $17,000 range sale to a Los Angeles jobber, a $17,500 motor-generator set sold to an oil company and a $15,000 assortment of 30- and 40-hp. motors to a steamship company. General electric reports a $12,500 assortment of 500- and 667-kva. transformers for a power company, a 75-kva. set, switchboard and accessories for an Idaho mine, two automatic regulators for Palo Alto and a voltage regulator for a sugar company. Copper mining activity is reflected in two recent heavy shipments of supplies to Bolivia. Prospective business includes a new lumber plant for Longview, a million-dollar irrigation project for the bed of Lake Tulare, an $800,000 addition to Stanford Hospital, five new hangars and new boundary light equipment for the Oakland airport, a proposed $5,000,000 640-acre bombing base for Marin County.

Sales of apparatus in the Puget Sound area reported last week include about $3,000 worth of central-station switching equipment for a power company and two 1,200- and five 800-amp. automatic oil circuit breakers costing $15,000 to the Seattle lighting department. Specifications will be out about September 15 from the city of Seattle for about $28,000 worth of underground cable, and the Olympic Products Corporation, a Zellerbach subsidiary, expects to issue specifications shortly for a pulp and sawmill at Port Angeles, equipment involving 5,000 hp. in motors, one 5,000-hp. turbine, switchboard and switching equipment, etc. Motor sales announced include two 100-hp. machines for a sawmill in Aberdeen, one 30- and twelve 2-hp. special motors for a sawmill in the Puget Sound district, ten from 15 hp. down for another sawmill, fifteen from 20 hp. down to dealers, ten from 60 hp. down to industrials and fifteen from 20 hp. down to orchards in eastern Washington. Elevators and motors for the Fidelity Building in Tacoma, costing about $100,000, will be bought shortly. Construction projects follow:

Pickwick Corporation, Los Angeles, Calif., has work under way on a plant for the manufacture of motor coaches at El Segundo to cost $150,000. Detroit Aircraft Corporation, Detroit, Mich., plans plant at Long Beach, Calif., to cost $150,000. Los Angeles Compress & Warehouse Company, Los Angeles, Calif., will build an addition to cost $85,000. Salinas Cold Storage Company, Monterey, Calif., plans cold storage and refrigerating plant to cost $180,000. Pacific Gas & Electric Company, San Francisco, Calif., plans extensions and improvements in street-lighting system at Placerville, to cost about $25,000. Aircraft Industries, Ltd., San Francisco, Calif., plans plant to cost $75,000. United States Metal Products Company, San Francisco, Calif., plans storage and distributing plant to cost $100,000. San Leandro, Albany, Long Beach, Culver City and Sacramento, Calif., plan ornamental lighting systems. Yorba Linda Citrus Association, Yorba Linda, Calif., has plans for a packing plant to cost $100,000. Paper Makers Chemical Corporation, Kalamazoo, Mich., plans plant at Portland, Ore., to cost $250,000. Peoples West Coast Hydro-Electric Corporation, Portland, Ore., plans addition to power plant at Salem, Ore., reported to cost close to $100,000. Stevenson, Wash., plans hydro-electric power plant in connection with municipal waterworks system, to cost about $75,000. J. B. Boswell Company, Litchfield, Ariz., plans cottonseed oil mill to cost $100,000. Phoenix, Ariz., plans installation of ornamental lighting system to cost $150,000. Allison Steel Manufacturing Company, Phoenix, Ariz., plans steel plant to cost $200,000.

New England

Sales are steady in New England. General scheduled material is reported to be active. Small switches, power control and service line materials are moving in good volume and records show continued steadiness in these lines; on the other hand, power needs are less active. Small motors were in less demand last week, though sales of one manufacturer reached over $20,000 and to date show an encouraging gain over last year.

Central-station supplies are quiet. Inside control apparatus orders for two stations totaling about $2,000 are noted. Line materials and hardware sales slackened recently, though one manufacturer records steady demands for service line extensions recently. Negotiations for heavy electrical equipment are quiet. Orders will soon be placed for switch and control for an eastern Massachusetts substation. Changeover from steam to electric power for one prominent manufacturer is announced and orders for equipment will be closed shortly. Merchandising is steady and according to one group of central stations shows an appreciable gain over last year. Fans, refrigerators and irons are selling well. Construction projects follows:

The Revere Knitting Mills, Inc., Malden, Mass., will build an addition to cost about $40,000. Eastern Massachusetts Electric Company, Salem, Mass., is having plans prepared for power plant on local site. The Charles B. Maquire Company, Providence, R. I., will build an addition to metal refining plant to cost $40,000. The Trumbull Electric Manufacturing Company, Plainville, Conn., has filed plans for two additions to cost more than $100,000.

Eastern

Fall trade looms strong in the Eastern district. Expanding account is under way with central stations and the industrials and record commitments are resulting for this time of year. Electric railway demand shows little abatement and millions of dollars are being diverted to this channel. A leading manufacturer of electrical equipment reports sales as averaging from $3,000,000 to $4,000,000 weekly for the past month, which indicates the present situation in an expressive manner.

Electric locomotives of the oil-battery type are securing peak business. A manufacturer of such units in Pennsylvania has booked sufficient orders to insure plant capacity for the next twelve months. The American Rolling Mill Company has contracted for two oil-electric locomotives to be built jointly by the Ingersoll-Rand Company, General Electric Company and American Locomotive Company. The New York, New Haven & Hartford Railroad Company has inquiries out for five rail motor cars of this type. The Western Electric Company has given an order to the Westinghouse Electric & Manufacturing Company for an oil-electric switching locomotive. A manufacturer of electric storage batteries in Philadelphia has received a commitment for 35 heavy type units for railway service, each weighing close to 17 tons.

Substation account is developing an excellent demand and a number of power companies have entered the market for immediate requirements. A metropolitan central station has placed an order for transformers to cost about $35,000. A Northern New York central station has given a commitment to a state maker for like equipment to cost close to $40,000. A power utility in West Virginia has contracted with a New York manufacturer for transformers and accessories to cost $150,000. A Connecticut central station has placed an order for regulators for a new station installation to cost approximately $200,000. Municipal power station account gives exceptional promise for the fall season and a sizable number of inquiries are out for prime movers and auxiliaries. A Nebraska municipality has placed an order for a turbo-generator unit, condensers and accessory apparatus. An Iowa city has contracted for a Diesel engine-generator installation. A metro-

politan power company has placed an order for cable for substation work to cost $178,000, while another local central station has contracted for cable for like purpose to cost $38,000. Construction projects follow:

New York Central Railroad Company, New York, will receive bids until September 20 for incandescent lamps. New York & Queens Electric Company, Flushing, L. I., will build an automobile service, repair and garage building for company cars at Elmhurst, L. I., to cost $100,000. Noma Electric Corporation, New York, will establish a radio equipment manufacturing plant at Lawrence, Mass., to cost more than $400,000. The Schnell Penselpen Corporation, New York, will build a plant for manufacture of combination pen and pencil at Arlington, N. J., reported to cost $60,000. Board of Education, New York, will soon take bids for a technical high school for boys at Brooklyn, with vocational training facilities, to cost $5,600,000. World Cleaners & Dyers, Inc., Mount Vernon, N. Y., will build a plant group of nine buildings to cost $200,000, and work on initial units has been started. Western Electric Company, New York, has filed plans for three additions to its plant at Kearney, N. J., to cost more than $400,000. Brewer-Tichenor Corporation, Cortlandt, N. Y., will build an addition to its automobile equipment plant to cost close to $80,000. Mount Vernon, N. Y., has plans for a municipal automobile service, repair and garage building to cost $100,000. State Department of Institutions and Agencies, Trenton, N. J., will build a power plant at Hillside, N. J., reported to cost more than $65,000.

Department of Property and Supplies, Harrisburg, Pa., will receive bids until September 20 for electric feeders and accessories and for high and low pressure steam equipment for State Hospital for Crippled Children at Elizabethtown. Gulf Refining Company, Pittsburgh, Pa., will build additions to oil plant at Girard Point, Philadelphia, Pa., to cost $100,000. Magee Carpet Company, Bloomsburg, Pa., will build an addition to cost about $100,000. Philadelphia & Reading Railway, Philadelphia, Pa., contemplates a freight terminal at Rutherford, Pa., to cost more than $2,000,000. Schuch Machine Company, Philadelphia, Pa., has filed plans for an addition to cost about $50,000. Aluminum Company of America, Inc., Pittsburgh, Pa., has approved plans for extensions in plant at Maryville, Tenn., to cost more than $250,000.

Activities of the Trade

Yard Locomotives Dispatched by Radio

An experimental radio communication system for dispatching yard locomotives that has been installed at the West Works plant of the Ashland division of the American Rolling Mill Company at Ashland, Ky., by the General Electric Company is being watched with interest by those interested in industrial uses of radio developments.

Radio equipment for communication between the front and rear ends of long freight trains had been previously tried out by several railroad companies, but this is believed to be the first installment of its type in an industrial plant. The equipment installed consists of two 50-watt transmitters and power receivers; one set is installed in the dispatcher's office at the Hood's Creek scale house and the other is installed on oil-electric locomotive No. 742. The equipment operates on a frequency range of from 2,250 to 2,750 kilocycles and is set at 2,440 kilocycles, corresponding to a wave length of 122.9 m. The transmitters have a broadcasting range of about 5 miles.

Two-way communication is provided, which enables the dispatcher to issue orders and to receive confirming replies. The sets have sufficient volume so that the engineer can plainly hear the orders from the loud speaker above the noise of the train, so that it is not necessary to use headsets.

This system enables the dispatcher to issue orders direct to the train crew, eliminating chances of errors. Due to the flexibility of the system more work can be done with a given number of yard engines. Another great advantage of this system of control is that in weighing a train of cars in a heavy fog any number of cars up to the capacity of the engine can be handled. Under the usual system of control it is necessary to cut a train up into sections of eight or ten cars when weighing a train.

Experiments along this line will be continued and similar apparatus is now being installed by the Westinghouse Electric & Manufacturing Company for comparative purposes.

Anaconda Wire & Cable Buys Marion Insulated

The Anaconda Wire & Cable Company has announced the purchase of the assets of the Marion Insulated Wire & Rubber Co., Marion, Ind. This mill will be operated as the Marion mill of the Anaconda Wire & Cable Company and J. F. Auten will continue as manager.

In taking over the Marion company, the Anaconda Wire & Cable Company acquires a manufacturing unit with excellent possibilities, it is stated. The Marion company is now manufacturing a complete line of rubber-insulated wire and cable as well as parkway and varnished cambric cables, its products having been well regarded over a period of many years.

While no definite announcement has been made, it is understood that the Anaconda Wire & Cable Company intends to expand the present Marion manufacturing facilities materially and, at the same time, to standardize its production with similar lines in other mills.

THE BREWER-TITCHENER CORPORATION, Cortland, N. Y., has just closed a contract with the Austin Company, Cleveland, Ohio, for a substantial addition to its Cortland forging division at Cortland. The Brewer-Titchener Corporation is a large supplier to the automotive industry of commercial forgings, stampings, brake rods and various other special products. It also makes an extensive line of drop-forged insulator caps and other forged hardware used on high-voltage power lines.

THE CHAMPION SWITCH COMPANY, Kenova, W. Va., in order to care for increasing demands for equipment, is adding 10,000 ft. of floor space to its switch assembly department. The floor units are so arranged that as more space is required it can easily and quickly be made available.

WAGNER ELECTRIC CORPORATION, St. Louis, announces that Ralph R. Rugheimer is now a member of the Atlanta branch sales office. Mr. Rugheimer spent quite a few years in the early days of his training on construction and central-station work, also 5½ years with the Westinghouse company. He is a native of South Carolina and a graduate of Newberry College in electrical engineering.

THE AJAX METAL COMPANY, Philadelphia, has just completed the construction of an entirely new plant which will be used exclusively for manufacturing Ajax-Wyatt electric smelting furnaces. Ample provisions have been made for carrying on experimental work, as well as providing most modern storage and handling facilities for several parts and lining materials.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY was recently awarded an order for six switch houses by the Florida Public Service Company, Orlando, Fla. The six switch houses are to be installed in the Winter Garden division of the Florida Public Service Company. They will be of standard steel construction with panel-mounted equipment inside of the house and will have an added feature of a superstructure framework with disconnecting switches mounted above the house. Five of the houses will be used for automatic reclosing feeder service with type GR automatic reclosing relays. The other house will also be used for feeder service, but it will not be equipped with automatic reclosing equipment.

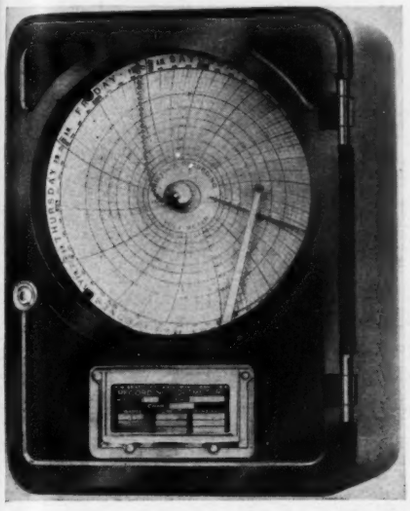
THE MARWOOD COMPANY, Seattle and Spokane, Wash.; San Francisco, Calif., and Portland, Ore., has been appointed distributor of Emerson motors on the Pacific Coast by the Emerson Electric Manufacturing Company, St. Louis, Mo. Stocks will be carried by the Marwood Company in its warehouses in each of the cities named.

New Equipment Available

Chart Recorder Designed for Substation Switchboards

A small-sized round-chart recorder, designed to fill the need for voltmeters and ammeters in modern substation practice, is announced by the Bristol Company, Waterbury, Conn.

The voltmeter is available with either of two forms of measuring element. The



moving-coil type embodies a fixed and movable coil electrically in series. In the moving-iron type the armature takes the form of a disk built up of an alloy of high permeability and low losses, lying in the field of a short, compact solenoid. In each case the moving part is carried on simple, rugged knife edge springs, one of which is directly connected to the recording pen arm. The moving-coil type is used where a complete scale is required, the graduations gradually widening as the upper ranges are approached. The moving-iron type of element provides very uniform width of graduation through a limited range and is particularly suited to calibration with a suppressed zero.

Hexagon Head Fuse Plugs

A new feature in the form of a hexagon head which will characterize all Royal Crystal fuses of an amperage of 15 or under is announced by the Royal Electric Company. It is claimed that this simplifies the question of replacement for the trouble man or contractor. The shape of the fuse will tell him instantly, even in the dark, the true condition of the circuit, whether it is over or under fused, it is claimed. Underwriters' specifications stipulate that fuses of 15 or under must have a hexagon window, so that the inspector can tell easily the condition of the current. It is stated also that the hexagon design permits a firm grip, allowing renewals to be made very conveniently. The fuses also have the complete Royal Crystal glass top of specially constructed glass.

Automatic Welding Outfit Has Electrode Feeding Device

A new and improved automatic welding outfit under the trade name "Weldomatic," complete with electrode feeding device, control cabinet and operator's panel, is announced by the Westinghouse Electric & Manufacturing Company. It is designed to operate with equal satisfaction with either Westinghouse variable voltage or constant voltage welding motor-generator sets.

This product has been developed to meet the demand for an automatic welder of compact dimensions to facilitate mounting on the welding tools and one that is equal in reliability to the usual shop tool. It automatically strikes and holds an arc between an electrode and the work to be welded without the aid of an operator other than to press the starting button. The feed device is a most compact design which permits its ready application to work handling tools. The drive motor is mounted in a cylindrical frame which supports the nozzle assembly. The nozzle has adjustment for being moved in two planes and the nozzle assembly can be reversed very easily to be either right-hand or left-hand assembly.

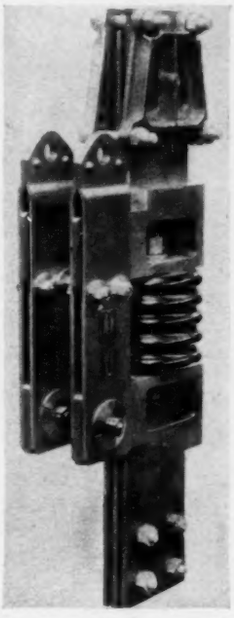
Positive feed without slippage, extreme sensitivity insuring instantaneous response to arc voltage conditions, wide range of speeds, compact mounting dimensions combined with light weight, simplicity of design, ease of adjustment and smoothness of operation are among the features claimed for this product.

ALL-IN-ONE OUTLET BOX—The all-in-one electric outlet box supported by two rods instead of one, which is designated to insure that the box remains perfectly plumb, avoiding crooked switch or receptacle plates, is announced by the Triplex Electrical Manufacturing Company, Chicago. The rods have sufficient strength to prevent the box being pushed back or out after being set in place, thus insuring that the box is flush with the plaster line.

A NEW AUTOMATIC WATER HEATER, called the "Adjust-O-Matic" water tank, is announced by the Westinghouse Electric & Manufacturing Company. It is a 20-gal. tank for household use, covered with heat-insulating material incased in sheet steel. The feature of the water heater is the adjustable automatic temperature control. Three cut-on temperatures are provided, low, medium and high. When the snap switch is on any of these positions the water is kept at that temperature indefinitely. As quickly as the water is used the thermostat automatically turns the current on for a few minutes, bringing the water back to the temperature it is set for.

Double-Blade Tongue Type Disconnecting Switch

A double-blade tongue type disconnecting switch, known as the WT-14, for clamping directly on busbars is announced by the Delta Star Electric Company, Chicago. It affords a con-



venient method of inserting a disconnect between the oil switch and bus, thus securing a high space factor and short runs to the oil switch terminal, according to the manufacturer.

A SMALL TINNING POT of a new design, for the use of manufacturers of equipment requiring smaller pots than are normally made, such, for example, as radio manufacturers and instrument makers, is announced by the Harold E. Trent Company, 439 N. Twelfth Street, Philadelphia. This pot is made only for 110 volts a.c. or d.c. and for single heat. The wattage is 375. The physical dimensions of the pot are 4 in. inside diameter by $\frac{1}{2}$ in. deep. The depth can be reduced $\frac{1}{8}$ in. if required.

A NEW MODEL CARBON ARC ULTRA-VIOLET RAY LAMP, producing the same invisible rays found in direct sunlight on bright clear days, is announced by the Fitzgerald Manufacturing Company, Torrington, Conn. A specially designed generator produces the healthful, warm, infra-red rays, as well. This lamp is ideally constructed for long carbon wear and is entirely automatic, no adjustment of the arc being necessary after the connection is made. A filter shuts out all but the beneficial rays. The lamp has heavy gleaming nickel reflectors and an adjustable and collapsible stand.

Electrical Patents

Announced by U. S. Patent Office

(Issued August 20, 1929)

1,725,716. PRIMARY BATTERY; M. L. Martus, Woodbury, and E. H. Becker and J. G. Ross, Waterbury, Conn. App. filed Dec. 21, 1926.

1,725,729. TRAIN CONTROL ACKNOWLEDGING CONTACTOR; C. S. Bushnell, Rochester, N. Y. App. filed March 16, 1926.

1,725,732. ELECTRIC WINDSHIELD HEATER; A. B. Cross and W. H. Frazier, Denver, Colo. App. filed Feb. 28, 1928.

1,725,734. DRY-STORAGE-BATTERY PLATE AND METHOD OF MAKING THE SAME; B. Heap, Clifton Junction, Manchester, England. App. filed Jan. 5, 1925.

(Issued August 27, 1929)

1,725,747. ELECTRICAL CONNECTER; E. H. Boone, Madison, Kan. App. filed May 17, 1927.

1,725,772. ELECTRIC ELEVATOR SYSTEM; R. A. Waite and G. W. Lautrup, Yonkers, N. Y. App. filed June 18, 1924.

1,725,773. ELECTRIC CONDUCTORS; J. H. White, Cranford, N. J. App. filed Nov. 19, 1924.

1,725,784. END BRACKET FOR DYNAMO-ELECTRIC MACHINES; E. E. Dreese, Euclud Village, and W. Lavigna, University Heights, O. App. filed July 29, 1927.

1,725,806. END BRACKET FOR DYNAMO ELECTRIC MACHINES; W. LaVigna, University Heights, and F. Malner, Cleveland, O. App. filed July 29, 1927.

1,725,953. CENTRIFUGAL REGULATOR FOR ELECTRIC MOTORS; J. Bethenod, Paris, France. App. filed June 2, 1923.

1,725,983. SECTION-CONNECTING SWITCH; G. E. Jansson, Wollaston, Mass. App. filed Feb. 10, 1928.

1,726,009. SUPERVISING AND CONTROL SYSTEM; T. U. White, Pittsburgh, Pa. App. filed April 28, 1925.

1,726,013. FIRE ALARM; W. T. Bridges, La Fayette, Ga. App. filed May 8, 1923.

1,726,014. ARMOR SAFETY SLEEVE; P. Carolan, Cleveland, O. App. filed Feb. 17, 1925.

1,726,038. OUTLET BUSHING AND WASHER; S. A. Meyers, San Francisco, Calif. App. filed May 31, 1927.

1,726,042. ROTOR FOR MAGNETOS; C. F. Reis, Chicago, Ill. App. filed June 7, 1927.

1,726,077. BUS CONSTRUCTION; T. G. LeClair, Chicago, Ill. App. filed March 26, 1927.

1,726,095. INSULATOR BUSHING AND MEANS FOR SUPPORTING CORES OR BAFFLES THEREIN; A. O. Austin, Barberton, O. App. filed Aug. 11, 1924.

1,726,096. MEANS FOR SUPPORTING BAFFLES IN OIL FILLED BUSHINGS; A. O. Austin, Barberton, O. App. filed Aug. 11, 1924.

1,726,097. INSULATOR BUSHING; A. O. Austin, Barberton, O. App. filed Aug. 11, 1924.

1,726,100. COIL WINDING; R. C. Da Costa, Philadelphia, Pa. App. filed May 24, 1928.

1,726,101. MOUNTING FOR ELECTRIC CONDUCTORS; W. R. Edson, New York, N. Y. App. filed June 17, 1926.

1,726,107. ELECTRIC DISCHARGE TUBE; G. L. Hertz, Eindhoven, Netherlands. App. filed Feb. 18, 1925.

1,726,111. METHOD AND ARRANGEMENT FOR OBTAINING PERFECT HIGH VACUUMS; S. Loewe, Berlin, Germany. App. filed Nov. 14, 1927.

1,726,182. ELECTRICAL DEVICE AND SYSTEM; M. J. Johnson, Bridgeport, Conn. App. filed Aug. 5, 1927.

1,726,204. TRUCK TYPE SWITCHBOARD AND INTERLOCKING MECHANISM FOR THE SWITCHES THEREOF; M. B. Wood, Somerville, Mass. App. filed May 19, 1927.

1,726,230. INDUCTION MOTOR; C. L. Kennedy, Braintree, Mass. App. filed Oct. 15, 1926.

1,726,231. INDUCTION MOTOR; C. L. Kennedy, Braintree, Mass. App. filed Oct. 15, 1926.

1,726,232. INDUCTION MOTOR; C. L. Kennedy, Braintree, Mass. App. filed Oct. 15, 1926.

1,726,253. ELECTRICAL DISTRIBUTION SYSTEM; J. D. Wood, Wollaston, Mass. App. filed June 23, 1925.

1,726,276. REGENERATIVE BRAKING SYSTEM; H. Osborne, Berlin-Wilmersdorf, Germany. App. filed March 14, 1924.

1,726,343. ELECTRICAL CONDENSER AND METHOD OF MAKING THE SAME; H. I. Danziger, New York, N. Y. App. filed Aug. 27, 1927.

1,726,349. MAGNETIC PROBE FOR SURGICAL PURPOSES; R. C. Hartsough, Berwyn, Ill. App. filed May 26, 1927.

1,726,365. LAMP FILAMENT; M. Pirani, Berlin-Wilmersdorf, Germany. App. filed May 10, 1928.

1,726,394. DUPLEX ELECTROMAGNETIC VIBRATORY UNIT; W. Heusser, Salt Lake City, Utah. App. filed May 24, 1926.

1,726,423. ELECTRICAL SIGNALING SYSTEM AND APPARATUS THEREFOR; W. B. Churcher, Cleveland Heights, O. App. filed Feb. 12, 1925.

1,726,424. ELECTROMAGNETIC RELAY; W. B. Churcher, Cleveland, O. App. filed Jan. 29, 1926.

1,726,429. DUPLEX RECEPTACLE; W. J. Ferris, Jackson, Mich. App. filed Oct. 6, 1928.

1,726,430. SINGLE RECEPTACLE; W. J. Ferris, Jackson, Mich. App. filed Oct. 6, 1928.

1,726,447. GLASS FOR TAIL LAMP STOP SIGNALS AND REVERSE LIGHTS; C. A. Michel, Cleveland, O. App. filed Jan. 10, 1923.

1,726,478. CONTROL OF MULTISPEED MOTORS; J. Eaton, Schenectady, N. Y. App. filed Sept. 10, 1924.

1,726,480. METHOD OF AND APPARATUS FOR MAKING CONCENTRATED FILAMENTS; A. Fehse, Berlin, Germany. App. filed May 7, 1927.

1,726,508. CONTROL SYSTEM FOR TRAIN CIRCUITS; H. E. Van Dorn, Chicago, Ill. App. filed Dec. 22, 1928.

(Issued September 3, 1929)

1,726,538. HARP FOR TROLLEY POLES; J. Carich, Miami, Ariz. App. filed Jan. 9, 1928.

1,726,540. DRY BATTERY; S. L. Casella, New York. App. filed Sept. 23, 1927.

1,726,543. IGNITION CONDENSER; L. F. Curtis and J. F. Martin, Springfield, Mass. App. filed Feb. 13, 1928.

1,726,547. RECOVERY OF REACTION PRODUCTS FROM GASES TREATED WITH ELECTRIC ARCS; O. Eisenhut, Heidelberg, Germany. App. filed Dec. 29, 1926.

1,726,551. ELECTRICAL CABLE; L. S. Ford, River Forest, Ill. App. filed Aug. 3, 1925.

1,726,586. ELECTRIC JACQUARD; W. Recke, Philadelphia, Pa. App. filed Oct. 22, 1923.

1,726,624. WELDING TONGS; E. S. Lawson, Los Angeles, Calif. App. filed May 15, 1928.

1,726,639. BATTERY-CHARGING SYSTEM; W. E. Addicks, New York, N. Y. App. filed Oct. 19, 1925.

1,726,641. AUTOMATICALLY - CONTROLLED ELECTRIC CONNECTION PLUG; M. C. Bersted, San Diego, Calif. App. filed Dec. 17, 1923.

1,726,653. RESETTING DEVICE FOR OPERATION INDICATORS; L. N. Crichton, Wilkinsburg, Pa. App. filed July 1, 1924.

1,726,656. TRUCK TYPE CIRCUIT BREAKER; D. R. Davies, Stretford, England. App. filed July 2, 1925.

1,726,658. HEATING DEVICE; O. J. Fay, Chicago, H. T. Heimberger, Riverside, and E. Pugh, Chicago, Ill. App. filed Dec. 23, 1927.

1,726,669. HIGHWAY SIGNAL; D. M. Kennedy, Seneca Falls, N. Y. App. filed Aug. 10, 1920.

1,726,670. TOY ELECTRIC RAILWAY SYSTEM; J. C. Koerber, South Orange, N. J. App. filed Feb. 7, 1928.

1,726,674. MOTOR CONTROLLER; R. G. Lockett, Milwaukee, Wis. App. filed March 20, 1926.

1,726,675. ELECTRIC SWITCH; H. I. Morris, Cleveland, O. App. filed May 9, 1924.

1,726,676. INCLOSED SWITCH; H. W. Neal, Mansfield, O. App. filed June 25, 1927.

1,726,683. SELF-LOCKING TERMINAL; W. H. Schramm, Pittsburgh, Pa. App. filed Dec. 29, 1925.

1,726,692. RADIOPLUG; A. J. Carter, Chicago, Ill. App. filed Aug. 2, 1926.

1,726,717. CIRCUIT BREAKING MECHANISM; E. H. Remde, Cleveland, O. App. filed Dec. 12, 1921.

1,726,734. ELECTRICALLY WOUND CLOCK; W. F. Eyles, Grand Rapids, Mich. App. filed Jan. 21, 1924.

1,726,738. APPARATUS FOR THE PREVENTION OF INCRUSTATIONS AND CORROSION ON METALLIC SURFACES; F. Hauptvogel, Vienna, Austria. App. filed April 17, 1925.

1,726,745. METHOD OF MAKING PLUG RECEPTACLES AND IMPROVED PLUG RECEPTACLES; E. R. Kulka, Brooklyn, N. Y. App. filed April 13, 1927.

1,726,748. ADJUSTABLE THERMOSTATIC CONTROL SWITCH; H. D. Matthews, Mansfield, O. App. filed July 27, 1926.

1,726,757. OVEN TOASTER; M. Murphy, Rushville, Ind. App. filed June 11, 1927.

1,726,760. COMBINED MOTOR-GENERATOR STARTING UNIT FOR TRACTORS; R. B. Otwell, Redford, Mich. App. filed March 7, 1928.

1,726,765. ELECTRICITY METER; R. Pudelko, Zug, Switzerland. App. filed Feb. 18, 1928.

New Trade Literature

BEDPLATES.—Bedplates for types SVR and DVR speed reducers is the subject of a new publication, circular 1856, issued by the Westinghouse Electric & Manufacturing Company. Information pertaining to construction, dimensions and weights and motor sizes for bedplates with and without outboard bearing pedestals is given in tabulated form, accompanied by outline drawings and illustrations.

CONTROLLERS.—The Monitor Controller Company, Baltimore, Md., is distributing bulletin No. 114, describing an automatic brake-stop printing press controller. The booklet opens with a list of the principal characteristics which feature this controller. Under such headings as control functions, control stations, operation, contactors, resistors, installation and inspection, the controller is discussed in detail and illustrated from various angles. This seven-page booklet closes with a page of diagrams and a table of dimensions and weights.

EVERSTICK ANCHORS.—Bulletin No. 29-A has been issued by the Everstick Anchor Company, St. Louis, Mo., describing the various types of anchor manufactured by the company. They are the improved expand screw anchor, the Everstick cone anchor, Everstick expanding anchors, the three-way Everstick and the two-way Everstick. A plentiful supply of illustrations brings out the dominant characteristics of each type and tables list sizes, weights, prices, etc. The last page of the bulletin is devoted to galvanized rods and tools for installing anchors.

DIESEL ELECTRIC DRIVE.—Special publication 1845, entitled "The Cargo Ship of Today," has been released by the Westinghouse Electric & Manufacturing Company. This interesting eight-page booklet describes the conversion to Diesel electric drive of the cargo vessels *Triumph* and *Defiance*. The Diesel electric propulsion of these ships has increased their speed from 9.5 to 15 knots. The advantages in weight and in first cost of the Diesel electric drive over the direct Diesel installation are shown. The principal particulars of the hull and machinery of these two vessels are listed and the propelling and auxiliary installations are fully explained. A list of other Westinghouse Diesel electric marine installations is given.

GROUNDOMETERS.—Bulletin No. 110 has just been issued by the Borden Electric Company, Newark, N. J., describing type D groundometer designed especially for measuring the resistance to the flow of current from a metal electrode into the surrounding earth. Its construction and operation are discussed at length in this twelve-page booklet.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Agency and purchase are desired in Melbourne, Australia (No. 40657), for armature winding wires and for battery containers.

Purchase is desired in Pretoria, South Africa (No. 40656), of electrical engineering sundries, including ranges, fireless cookers, motors and tools.

Agency and purchase are sought in Addis Ababa, Ethiopia (No. 40735), for flashlights.

Agency is desired in Melbourne, Australia (No. 40684), for electric heating and cooking appliances.

Agency and purchase are desired in Buenos Aires, Argentina (No. 40708), for farm-lighting outfits.

Agency and purchase are desired in Buenos Aires, Argentina (No. 40715), for self-contained farm-lighting outfits.

Either purchase or agency is desired in Medan, Sumatra (No. 40716), for electric motors for driving rice mills and light sawmills.

Purchase is desired in Pretoria, South Africa (No. 40656), of household refrigerators.

An agency is sought in Melbourne, Australia (No. 40684), for vacuum cleaners.